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# Unasylva

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An International Review of Forestry and Forest Products

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### FAO Technical Committee on Wood Chemistry

The proceedings of the fifth meeting of the above Committee, held at Appleton, Wisconsin, USA, in September 1951, will shortly be published in the Forestry Studies Series. In the meantime, the series of papers on *Tropical Woods as a Source of Pulp* presented at the meeting has been reprinted in the April 1952 issue of TAPPI, which is published monthly in the U.S.A. by the Technical Association of the Pulp and Paper Industry. In an introduction, Harry F. Lewis, Dean, The Institute of Paper Chemistry, says "One of the important issues facing those interested in expansion in the manufacture and use of pulp and paper on a world-wide scale is the source of the fibrous raw material from which to make first the pulp and then the paper. Certainly the wood resources of the United States, Canada, and the western half of Europe cannot support in any permanent way a greatly increased industry, and the enormous wood resources of the U.S.S.R. are not available. It becomes necessary, therefore, to locate currently unused fibrous materials (and) define the possibilities inherent in the two greatest available fibrous reservoirs — namely, the tropical woods and the agricultural residues ... It will quickly become apparent that the problems of the forester and pulp manufacturer have not all been solved."

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### Other Forestry Studies

Two other forthcoming publications in FAO's Forestry Studies Series are **Elements of Forest Fire Control**, and **Grazing and Forestry**. Both of these deal with aspects of Forestry which are of world-wide importance, and the latter especially is of the greatest concern at present, when emphasis is being more and more laid on integrating the proper use of land to achieve the maximum output of ood and of industrial products.

These two important books are already in course of production and should appear within the next few months.

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# *Unasylva*

**An International Review of Forestry and Forest Products**

**Vol. VI, No. 2** **June 1952**

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**Cover Photograph:** *Sand-Dune Fixation and Afforestation in Libya are both seen here. The dunes near Zuara are being fixed with a network of grasses and reeds* (Psamma arenaria), *and within this network pines have already been planted. This is the work described in pages 51-58.*

## SPREADING KNOWLEDGE

THE heart of FAO's task in Forestry is to help people of many lands to follow the arduous road of forest conservation and use. To this end many devices contribute — conferences, study tours, discussions, visiting specialists in various fields — all aimed at direct co-operation with technicians of the countries concerned. Such measures are indispensable.

But reflection, experience, and the most casual study of statistics show such a method of consultation can work only slowly with the many nations and very many problems demanding attention. Only the written word can really fill the void.

The activities of FAO and other agencies are unquestionably stimulating interest in forestry in many places. But clearly the enthusiastic director of administration or research and the ambitious forestry worker still cannot find a ready-made answer to the proper and insistent question, "Exactly where can I find the most significant technical material produced to date, which may contain fertile ideas applicable to my own project or task?"

Current bibliographies necessarily list the trifling and the weighty alike, and the annual thousands of titles inevitably bewilder the student unless he already knows which authors or journals usually say something worth-while.

The admirable and painstaking *Forestry Abstracts* issued on behalf of the British Commonwealth countries singles out technical publications judged significant, but, like the Bibliography of the United States Department of Agriculture, it deals only with current material.

In too few of the many aspects of forestry have comprehensive and up-to-date critical summaries of work been prepared by men equipped with the necessary scholarship, maturity, poise and critical faculty. Such analyses are usually only national in scope. Many more of an international scope are needed.

Naturally enough, for local, regional or national projects, authors tend to write specifically to a limited audience, and so commonly the "review of previous work" and "selected bibliography" tend to cover primarily only individual, institutional or national items.

This kind of parochial approach was understandable in times before the United Nations undertook the task symbolized by the term "Unasylva." Today it is not enough. Authors and directors now have the opportunity, and indeed an obligation, to aid in the great task of spreading knowledge and ideas to eager workers everywhere, to help them avoid the dead ends of earlier work, and to give them a solid foundation of the world's tested experience.

The recognized discipline of scholarly work involves exploration of pertinent technical literature, and the top ranks of workers and directors are usually not, in fact, as parochial as perusal of their summaries of earlier work might indicate. Some workers and institutions already have made the change. The problem is to make the exception the rule.

*Two aspects of the sand dune problem in Tripolitania are seen here. Above, maritime sand dunes are steadily invading the palm groves of Zliten, slowly but surely burying and ultimately killing the trees. Below,* Acacia cyanophylla *and* Ricinus communis (*castor oil plant*) *are successfully growing in the sand dunes near Tripoli. In the foreground is a plant of* Calotropis procera. *The cover photograph of this issue shows a further scene, this time at Zuara, where pine seedlings are growing among the partly fixed dunes.*

# Sand-Dune Fixation and Afforestation in Libya

by JEAN MESSINES
Lately FAO Forestry Adviser in Libya

*The problems involved in afforestation and sand-dune fixation in Libya apply to most of the Near East. Thus, while this article is limited to a discussion of these problems in Tripolitania, M. Messines' conclusions apply to a far greater area than that with which he is specifically concerned.*

The first impression of a traveler visiting Tripolitania is that all is desolation and waste. This is due to the immensity of the steppes and the lack of forests but, above all to the invasion by sand. Were it not for an occasional coastal oasis, the cultivated Italian concessions, a few half-hearted attempts at afforestation, and the rather beautiful scattered plantations along the coast, one could well believe that the desert had conquered the whole country.

One does not have to go far into the interior to find desert. The suburbs of Tripoli are surrounded by vast stretches of almost bare sand, sometimes flat but more often forming unending small dunes. These phenomena of wind erosion are much more noticeable in Tripolitania than in other parts of North Africa. Their causes are manifold and mainly originate in the unfavorable topography and climate.

*Topography*

The lay of the land in Tripolitania constitutes only a very slight barrier against the wind from the south, the Ghibli. There is no high screen of mountain range separating the true desert from the sea, but only an irregular plateau at an elevation of 300-600 m., rising in some places to a maximum of 800 m., which overtops a large coastal plain, the Jefara. This is undoubtedly enough of a barrier to allow Tripoli and the coast sector to enjoy a comparatively favorable climate, but as an obstacle it is neither high enough nor sufficiently continuous to prevent the Ghibli from blowing over the plain, occasionally with incredible violence, picking up, transporting, and depositing thousands of tons of sand.

*Climate*

The climate also favors wind erosion. Aridity causes the vegetation to remain stunted, providing inadequate soil cover. Rainfall is low, always less than 400 mm. Mean maximum precipitation figures collected at the Agricultural Experiment Station at Sidi-Mesri, 5 km. from Tripoli where the dunes begin, average only 379 mm. Throughout all the Jefara, rainfall varies from 100 to 350 mm. Furthermore, it occurs irregularly, and is badly distributed. It only rains in the autumn and the winter, the three summer months being entirely dry.

Summer temperatures are sometimes very high; a maximum of 58°C. (136.4° F.) has been reached at El Azizia. On the coastal plain, at Misda for instance, the heat may become as intense as in the desert. Despite the mild winter temperatures, the extreme summer heat is responsible for a great range of temperature between the seasons.

There are three climatic zones in Tripolitania:

1. The entire central and eastern mountain (Jebel) area, the coastal plain of Dafnia and lesser Jefara, the littoral from Sabratha to Misurata, via Tripoli, all have a semi-arid Mediterranean climate.
2. The Jebel-Nefusa, from Yefren and the eastern portion of the great Jefara around El Azizia, are in the arid Mediterranean sector.
3. The entire western greater Jefara and the plateaux south of the Jebel, including Misda and Beni-Ulid, are in the Saharan area.

Naturally, there are some variations in each of these zones. For instance, Tripoli and the northern portion of the lesser Jefara enjoy the moderating effect of sea temperatures and moisture, and are the most favored regions from the standpoint of rainfall.

Taking these factors into account, what parts of Tripolitania could be successfully afforested? Generally speaking, afforestation is possible (even without any special precautions, such as the regular watering of plants during their first years) in the entire area of regular rainfall of over 200 mm. This area has a semi-arid Mediterranean climate, where the growing of olive trees is practicable. The chief problem in afforestation of this area is sand, for it is this region that sand invades the most. This threat can be met, however. There are means of combating wind erosion, at least in areas where the sand is still shifting.

*The Soil*

There are sand dunes throughout Tripolitania; the desert is indefatigable in its attack. The tiny particles of sand, blown gradually or by a storm over the inland hills, are deposited over the entire plain. When the Ghibli blows, the sky darkens and assumes a characteristic reddish color. The mobility of the sand presents a constant menace, imparting to the lesser Jefara, and particularly the areas south and east of Tripoli, the appearance of a desert. Thus, in this Mediterranean zone, the sand forms true ergs of the Saharan type.

From the interior of the African continent come the red (Heix) sands, composed mainly of very fine quartz granules. But there are also the sea sands, white, with rounded, rough textured and more calcareous grains, less able to retain water than the continental sands. Sea winds, blowing mainly from the northeast, form vast seashore dunes along the entire coastline from Zuara to Misurata, particularly at Side-Benur, Zliten, etc. These red and white sands meet in the coastal area, and the dunes which they form are frequently very close to one another. Ordinarily, there is bare steppe between these dune formations, which are still mobile and consist of pure sand. Sometimes the steppe itself overlies old deposits of sand which had once invaded the area and covered all other formations. This sandy, undulating terrain, sometimes levelled for the shifting cultivation of cereals, is still grazed by herds of small livestock. However, the equilibrium seems precarious, and it would probably take very little to upset it.

Overgrazing of steppe pastures and damage to vegetation by the goat — "the razor of the globe," as F. Cavara so aptly describes it [1] — has resulted in extreme deterioration of the soil. When drought occurs and lasts for several years, the soil, deprived of its vegetative cover, is blown away by the Ghibli and is gone for ever.

*Natural Vegetation*

The vegetation of the Tripolitanian steppe is poor and sparse with little variety of species. Those species which do grow are more or less drought-resistant. Being xerophytes, they generally have a highly developed root system and their foliage is reduced to a minimum; their leaves are generally filiform, dry and shiny, the epidermis thickened and cutinized. Many species are spherical in shape. Most of the bushes are spiny and prickly.

In the Jefara, the steppe looks in spots like the Mediterranean coast; elsewhere, like the interior predesert continental areas and, in the extreme western section, just like the Sahara.

*Woody Species*

In the past, forest certainly covered large expanses of Tripolitania. What type of forest it was is not precisely known, but there are still remnants of ancient stands. The most remarkable is the forest park of *Acacia tortilis* (Arabic: *Talha*), in the greater Jefara, north and northeast of Gasr-el-Hag in an area where precipitation is less than 150 mm. Trees are spaced from 50 to 100 m. apart, but at least they are trees. The best-known stand of this species in North Africa covers about 30,000 ha. in southern Tunisia. Much smaller stands of acacias are found in several parts of Algeria and Morocco and in the desert steppes of Cyrenaica as well. Under present conditions, this tree has no great economic value; it is too slow-growing, and in this arid climate may only produce a stand with a density of 20 to 25 trees par ha. at best. While this acacia does not seem suitable for general afforestation purposes, the stand at Gasr-el-Hag might be set aside as a national forest reserve where livestock-grazing is prohibited. If this step were taken, regeneration would occur there naturally without much difficulty.

In the same region, along the road from El Uotia to Giosc at a place called El Ghezuania, an old stand of *Tamarix articulata* (Arabic: *Etal*) existed until a few years ago, when nomads destroyed it completely. Despite the age of the trees, shoots are still growing from the old stumps. This remnant of ancient forest ought also to be conserved and set aside as a national reserve.

The most common woody species of Tripolitania is *Zizyphys lotus* (Arabic: *Sedr*). This may grow into a tree, but it generally becomes bushy since it is browsed by goats. Its spiny and tufted branches have a special propensity to hold moving sands which accumulate in curious hillocks around networks of branches which grow taller as the sand becomes fixed. This type of vegetation, with dispersed clumps of trees, covers large areas. In less abundance are *Pistacia atlantica* (Arabic: *Batum*), found at the foot of the Jebel, and *Rhus oxycantha* [2] (Arabic: *Gedari*). Other natural woody flora include *Nicotiana glauca, Ricinus communis* (Arabic: *Gherua*), *Calotropis procera* (Arabic: *Osciur-Cronca*) and several species of *Tamarix* (*gallica, africana*). These are all bushes, but, apart from the castor-oil plant, the usefulness of which in fixing sands will be discussed below, these species are not suitable for afforestation in Tripolitania because of their slow growth and insignificant economic value.

*Plants of the Steppe*

The steppes themselves vary greatly in appearance and features. During the rainy season, in areas of stable sands, a fine grass cover, rich in legumes and including many perennials, blankets the soil. The types of perennials which grow on the steppes serve to classify the land structure and vegetation community, as follows:

1. *Asphodelus microcarpus* (Arabic: *Belus*), and less frequently Squill (*Urginea maritima* — Arabic: *Ansil*) are types of vegetation found in moist, deep, flat sand. Occasionally Squill constitutes the only steppe vegetation, and sometimes the two plants form a community.

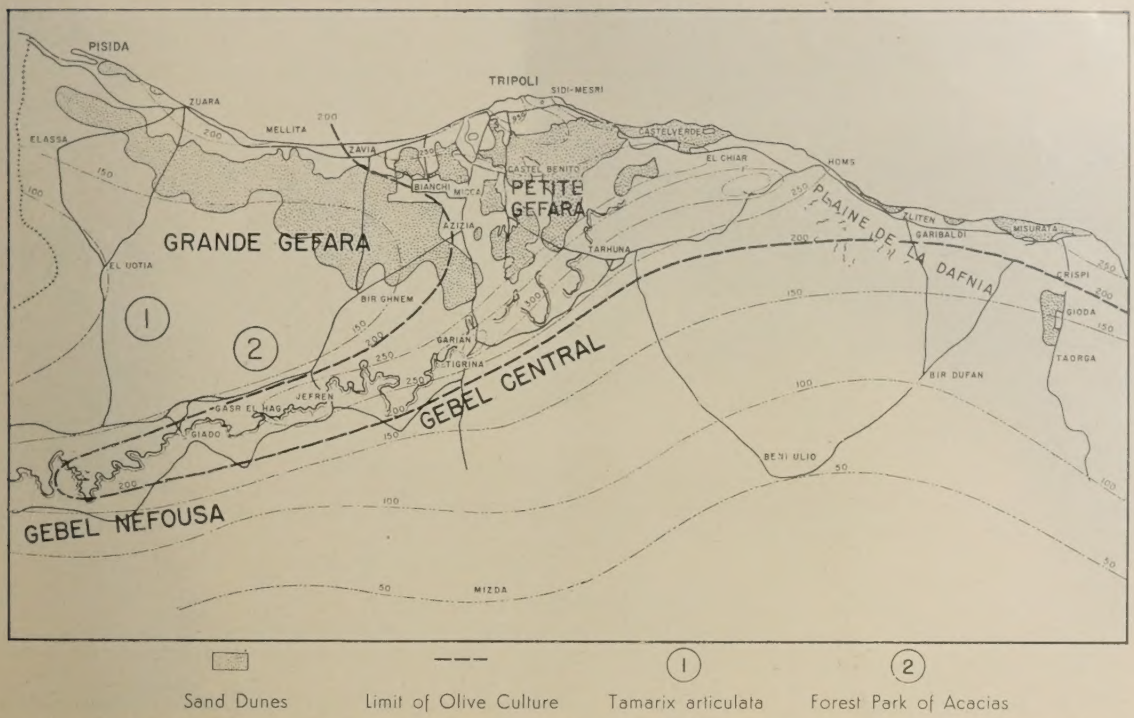
2. *Artemisia campestris* (Arabic: *Sciaha*) requires the same conditions as *Asphodelus* and grows with it. It prefers undulating, sandy soils.

3. *Imperata cylindrica* (Arabic: *Dis*) [3] grows on the poorest soils, still deep and moist, but sometimes slightly salty. This plant takes root in sand and, as will be shown below, may be useful for dune fixation. Another bushy, graminaceous plant, *Psamma arenaria*, equally useful in sand-dune fixation, grows along the littoral in the seashore sands.

[1] CAVARA, F., *Vegetation in Tripolitania, and economic use and agricultural development of the new colony.* Naples, 1914.

[2] In Tripolitania, one does not find the very special community of *Rhus* and *Pistacia ientiscus*, in the form of scrub, which is so common in Cyrenaica on the coastal plain between Tocra and Tolmeita.

[3] Arabic: "Dis" stands for *Imperata cylindrica* and *Psamma arenaria* in Tripolitania, and *Ampedolesma mauritanicus* in Algeria.




*This map should be compared with the account in page 51 of the three climatic zones of Tripolitania. The area suitable for afforestation is roughly that within the limits of the olive culture line.*

4. The presence of *Retama retam* (Arabic: *Rtem*) indicates deep, rather dry soil with undulating surfaces. The xerophylous nature of this plant is very marked. It frequently constitutes a community with *Aristida pungens* (Arabic: *Drinn*) and *Ricinus communis*, the bush mentioned above. Overcutting of *Rtem* for fuel has frequently led to soil deterioration and the formation of shifting sand dunes.

*Drinn*, which grows in conjunction with *Rtem* in shifting sands, has long, creeping roots which spread out over the sand and try to penetrate it. These two plants are invaluable along with *Dis* in sand-dune fixation work for afforestation purposes. Sometimes *Drinn* alone is found to constitute the entire steppe vegetation. It is characteristic of a dune which has not yet become fixed.

5. *Calycotome intermedia* (Arabic: *Gandul*) is a small spiny bush which prefers deep, stony soil. It betrays the presence of a hard-pan below the surface, a characteristic not only of this area, but also of all arid countries. These hard-pan or crust soils of the arid Mediterranean climate are found widely, particularly in the Jefara, where they are often overlain by sand deposits of more recent origin.

6. Where the soil is somewhat thicker and the sand cover less heavy, *Deverra tortuosa* (Arabic: *Guzzah*) and *Thymelaea microphylla* (Arabic: *Metnam*) occur. Large areas in the Dafnia plain toward the east between the Homs (Lebda) and Misurata are covered with this type of vegetation. On the more superficial terrains, where the hard-pan crops out on the surface, the characteristic plant of the steppe is *Gymnocarpus fruticosus* (Arabic: *Gescrud*) or *Rantherium suaveolens* (Arabic: *Arfège*).

7. Mountain-types of vegetation and, more frequently, the pre-desert types which are more common to the Jebel and the southern plateaux also occur in parts of the plain, especially in the western greater Jefara and in the area south of Taourga. *Artemisia herba alba* is an outstanding example in this category.

These various types of steppe vegetation are of interest to the agronomist as well as the silviculturist. Of all the types of terrain discussed, only the first two, the steppes with *Asphodel* and *Artemisia campestris*, can still be used for agricultural purposes. Assuming a minimum of 200 mm. rainfall annually, these steppes, as well as those characterized by *Dis*, *Rtem* and *Drinn*, can be afforested.

### *Sand-dune Stabilization and Afforestation*

The climate limits feasible afforestation in the plain to the lesser Jefara and the coastal area. The prime objectives of forestry in this region should be to fix and afforest: (1) the more or less mobile continental sands; (2) the steppes which are more or less covered by vegetation and occasionally those which are almost entirely devoid of vegetation, and (3) in areas where such protection measures are urgently needed, to undertake the difficult operation of afforestation of seashore sands.

Italian foresters worked out successful techniques for stabilizing the sands, and as a result of their efforts several thousand hectares of dunes have already

*The maritime sand dunes are as great a threat as those of the desert, as this picture from near Zuara shows. The oasis itself is threatened by the dunes' invasion, and the fig trees in this photograph are already half buried.*

been fixed and afforested. After their initial research excellent practical results were obtained, particularly from the standpoint of protection of highways. A drive along the 30 km. road from Tripoli to Castel Benito suffices to show how successful the work has been. Before the Italian Forest Service started its work, the roads from Tripoli to Homs (Lebda) and into the interior were unsafe and necessitated many detours. Today, the main roads are well-established and safe.

While the technical methods for dealing with seashore dunes and with continental dunes are almost identical, there is an essential distinction to be drawn between the two.

Continental sands comprise very fine grains which can be fixed by a network of low, thickset hedges, and dead vegetation litter (dune grass, rushes, etc.). *Dis* (*Imperata cylindrica*) is the plant most commonly used for this purpose. Small, flexible and penetrable obstacles considerably hamper the shifting of sand but do not completely prevent it. They enable trees to gain a foothold in the square or oval patches of *dis*, averaging 4 x 5 m., and can fix sands for young forests. The topography is altered as little as possible. Rigid obstacles and high barriers are proscribed; palisades, high rigid and continuous fences cause heavy accumulations of sand which pile up and consolidate, just the opposite of the desired result.

For seashore sands, on the other hand, high continuous barriers are preferable. They help build up artificial littoral dunes, in the shelter of which the sands invading the inland palm groves can be fixed and covered with small, low thickets. Thus, a combination of both methods is called for.

*Sand Afforestation*

A technique which several specialists consider to be an indispensable adjunct to sand-dune fixation, namely the covering of an entire stretch of sand with branches or sticks, has been abandoned in Tripolitania. Another idea that has been given up is the artificial sowing of grasses, such as *Rtem*, or the planting of woody species like the castor-oil plant, as a help in stabilizing the sand and allowing other plants to gain a foothold. Experience has shown that seeding by appropriate plants will occur quite naturally.

A long process of elimination has finally resulted in the selection of the following woody species suited to sand fixation:

1. *Acacia spp.*, above all, *Acacia cyanophylla*. This is a variety of *A. saligna* Bentham, from which it differs only in the color of its leaves. Elsewhere in Tripolitania all transitional forms of this species are found. This acacia flourishes on the southern coast of western Australia,[4] in the areas of dry summers and rare winter rains. It is interesting to note that it grows there on sandy moors over deep calcareous sands near stands of *Eucalyptus gomphocephala*, which has been almost as successful as *Acacia cyanophylla* in Tripoli-

tania. The climate of Libya is admirably suited to both species.[4]

*A. cyanophylla*, because of its abundant flowering and excellent capacity for survival, is the tree *par excellence* for Tripolitania. It fixes the soil well by its extensive root network, both close to the surface and to great depths and affords even better shelter to grass than eucalyptus. It also encourages humus and top soil. It throws out new shoots and suckers prolifically when young to ensure the future of the stand, and it produces an abundance of low branches which spread out and form a canopy, so that there is no heavy undergrowth and little fire hazard.

The wood is only useful for fuel and charcoal, but experiments have already been made, and are worth continuing, on ways of utilizing the tannin content of the bark on an industrial scale; thus far, the results have been inconclusive. The tannin content of the bark of *A. cyanophylla* is lower than that of other Australian acacias (*mollissima, picnantha*), but unfortunately the latter species have proved less successful for sand-dune fixation.

For afforestation work, 1-year-old plants raised in pots in nurseries are used.

2. *Tamarix*. The second species selected is *Tamarix articulata*, which has also been highly successful, especially in maritime sands. It can grown on salty lands and is resistant to sea winds, fog, spray and storms. At Zuara, on the coast, *Tamarix* seems to be the species best adapted to the environmental conditions. Seven- to eight-month rooted slips from nursery beds are used.

3. *Castor-oil plants*. Finally the ordinary castor-oil plant (*Ricinus communis*), highly prized for its beans and lubricating oil (in great demand as an export commodity) has many uses. It is good for sand-dune fixation and as a wind-break, and does not need irrigation. The Libyans are familiar with this plant and have been using it successfully around Tripoli. Its use is therefore particularly to be advocated on private holdings.

*Robinia pseudo-acacia* was at one time used on a large scale by the Italians, but with few exceptions the results were not apparently very good. The cost of planting this species is less than for *A. cyanophylla* because seedlings without special root protection can be grown in the open and the young trees constitute a windbreak very quickly and therefore very economically. However, the resultant stands generally look sickly, are of irregular growth and yield very little wood. Black and Carolina poplar, which have also been tried, proved disappointing and were quickly discarded.

Eucalypts can be very valuable provided they are not used as the initial species for dune fixation. They may be used on stable, sandy steppes, to prevent the shifting of sands, and as a substitute species after the first acacia crops have been cut on dunes already fixed and afforested. The two species most widely found in Tripolitania, and which have already proved their worth, are *E. rostrata* and *E. gomphocephala*. Both have a highly satisfactory rate of growth but the latter seems to have a longer life and grow to greater dimensions, giving more and better quality sawn timber. Furthermore, it is adaptable to calcareous soils and should definitely be given preference.

*Pinus halepensis* and *P. pinea* can be used on a small scale for the afforestation of sandy steppes between shifting sands. Their rate of growth is slow and, for sand-dune fixation, they are less effective than acacias. On the other hand, the pines yield timber, both saw wood for construction and small dimensional stock and box wood, and are therefore of commercial value. They can be planted in shelter-belt rows like *Eucalyptus, Cupressus sempervirens, Casuarina equisetifolia*, and *Acacia horrida*, and in borders around cultivated fields and along roads and pathways in agricultural areas, both on private lands and state-owned areas.

*Water resources*

The question of the density of stocking of plantations on sands raises the delicate problem of water resources.

The water table of the Tripolitanian littoral and coastal plains as well as throughout the Jefara lies at varying depths. Near the sea, water is found at a depth of 4 to 5 m., even under the sand deposits. Innumerable wells (over 8,000) around Tripoli account for the prosperous littoral oases. In the Jefara, wells are much fewer and have to be dug to greater depths to reach water, up to 40 m. at El Azizia and over 80 m. further inland, near the hills. These wells are used mainly to water livestock on the grazing lands. The water is generally cool and drinkable but the supply is not inexhaustible and the flow diminishes seriously in summer. At present the water table seems to have reached a disturbingly low level, which indicates a lessening of the ground water reserves and a need for prudence in the development of agriculture and forestry.

In arid and semi-arid areas, rainwater alone does not suffice to maintain the vegetation which must depend to some extent on water translocation within the earth's strata. In Tripolitania, runoff water very seldom reaches the sea; rainwater either infiltrates into the soil or evaporates. There are two kinds of evaporation processes, namely:

1. *Physical evaporation*, which depends on whether or not the soil is covered with vegetation. It has been measured experimentally, and in the temperate zone from a quarter to a half of the total rainwater is found to be lost through evaporation. It has been calculated that in desert or subdesert areas potential evaporation could be 30 to 40 times the total rainfall. On forested land, the rate of evaporation is estimated at one-third of that on bare areas.

2. *Physiological evaporation*, which results from transpiration and the assimilation requirements of the vegetation. This varies from species to species,

[4] Located between 32° and 33° latitude North, Northern Tripolitania from the standpoint of climate is very similar to Australia, which is located in approximately the same part of the world but at the antipodes. This leads us to expect that varieties of *Acacia* and *Eucalyptus* from south-western Australia can be used successfully for afforestation in Tripolitania.

## COMPARISON OF CLIMATIC CONDITIONS OF SEVERAL SITES IN LIBYA AND AUSTRALIA

| Site | Region | Annual rainfall in mm. | Min. | Average min. | Temperature range max. | Q (*) | Climatic conditions (as compared with Mediterranean climate) | Comments Area where the following plants grow naturally. |
|---|---|---|---|---|---|---|---|---|
| **Libya** | | | | | | | | |
| Tripoli . . . . . | Littoral | 353 | - 0.6 | 8-22 | 16-31 | 40 | Semi-arid | |
| Suara . . . . . | Littoral | 224 | 0.1 | 7-22 | 16-31 | 25 | Semi-arid | |
| Castel Benito . | Small Jefara | 295 | - 4.2 | 5-19 | 18-37 | 22 | Arid | Tripolitania |
| El Azizia . . . . | Great Jefara | 214 | - 3.2 | 5-20 | 17-40 | 15 | Arid | |
| El Uotia . . . . | Great Jefara | 98 | - 2.5 | 5-19 | 17-38 | 7 | Saharan | |
| Soluch . . . . . | Coastal plain | 186 | - 0.1 | 6-18 | 18-34 | 16 | Arid | |
| Barca . . . . . | First bench | 485 | - 3.9 | 5-16 | 16-32 | 48 | Semi-arid | Cirenaica |
| Cyrene . . . . . | Mountain | 598 | - 5.6 | 4-17 | 2-28 | 80 | Sub-humid | |
| **Australia** | | | | | | | | |
| Alice Springs . | Central desert | - 270 | - 5.5 | 3-21 | 19-36 | 20 | Arid | Irregular rains |
| Kalgoorlie . . . | Southwestern Australia, West | - 240 | - 1 | 7-15 | 17-34 | 20 | Arid | Rainfall better distributed than in Libya, but with dry summers. *E. salmonophlois, E. brockwayi, A. aneura* |
| Deniliquin . . . | New South Wales | - 400 | - 3 | 5-16 | 15-35 | 37 | Semi-arid | Rainfall better distributed than in Libya. *E. rostrata, A. picnantha* |
| Snowtown . . . | Southern Australia | - 390 | - 3.3 | 5-14 | 20-32 | 42 | Semi-arid | — |
| York . . . . . | Southwestern Australia, West | - 435 | - 4 | 5-16 | 17-36 | 40 | Semi-arid | *A. cyanophylla* and *A. cyclops* |
| Narrogin . . . . | Southwestern Australia, West | 505 | - 3 | 5-13 | 15-31 | 55 | Sub-humid | Rather pronounced drought in the summertime. *E. astringens, E. salmonophlois* |
| Port Lincoln . . | Southern Australia | 480 | 0 | 7-15 | 15-22 | 80 | Sub-humid | Summer drought. Low temperatures. *E. cladocalyx* |
| Adelaide . . . . | Southern Australia | 530 | 0 | 5-17 | 15-30 | 61 | Sub-humid | High temperatures. *E. rostrata* |
| Bendigo . . . . | Victoria | 525 | - 5 | 4-14 | 12-30 | 58 | Sub-humid | Rainfall better distributed than in Libya. *E. sideroxylon, A. picnantha* |
| Katanning . . . | Southwestern Australia, South | 525 | - 5 | 4-14 | 12-30 | 54 | Sub-humid | *E. occidentalis* |
| Busselton . . . . | Western Australia | 800 | - 1 | 6-14 | 11-28 | 107 | Humid | Dry summers. Chalky and sandy soil. *E. gomphocephala* |
| Kempsey West | NSW Australia | 1135 | - 8 | 5-12 | 19-30 | 107 | Humid | Humid, non-Mediterranean climate. Abundant rainfall at all seasons. *E. saligna* |
| Mount Gambier | Southern Australia Tasmania | 770 | - 5 | 6-12 | 14-25 | 130 | Humid | *E. viminalis, A. mollissima* |

(*) Emberger's pluviothermal coefficient. This formula is considered to be better adapted to Mediterranean countries than Martonne's index of aridity. Emberger's formula is as follows:

$$Q = \frac{100\ P}{2\ \frac{(M-m)}{2}\ (M-m)}$$

in which M and $m$ stand respectively for the means of the maximum temperatures in the hottest months and of the minimum temperatures in the coldest months, and P represents precipitation in mm.

According to this formula, the Q coefficients for the first zone described above would be between 25 and 50; for the second, less than 25, and for the third under 10.

*Before World War II, much good work was done by the Italians in the way of dune fixation and afforestation, and this desolate area was once covered with coppice of* Acacia cyanophylla, *one of the most successful species, which has now been clear-felled.*

depending on the part of the world where they grow and on the season of the year. Investigations in this field are as yet too incomplete and fragmentary to draw any satisfactory conclusions.

Take the case of a eucalyptus plantation with spacings of 6 x 6, which means about 270 stems per ha. A single, well-grown tree, under the Tripolitanian climate in the middle of the summer, will through transpiration give off at least 200 litres of water per day. Even allowing for a considerable decrease in the rate of transpiration during the winter or when the vegetative growth is slowed down (which is only for a short period under the climatic conditions of Tripoli), the physiological evaporation of a eucalyptus stand of this type would be from 8,000 to 10,000 $m^3$ by volume per ha. per year. This corresponds to a water level of from 800 to 1,000 mm.

There are obviously many unknown factors to such a calculation and the figures are only given with the greatest reserve. However, they do tend to suggest that, in Tripolitania, a spacing of eucalyptus trees 6 m. apart is too close. One need only inspect the stands in the public domain at the Hascian Preserve in the sandy region, to be certainly convinced that trees spaced 5 x 5 are overcrowded. Growth would have been much better if they were spaced 7 x 7 or even 8 x 8. With only 150 trees per ha., the aggregate volume of timber would have been much greater and the quality of the product better.

To revert to the question of evaporation, we have already estimated that a eucalyptus plantation can transpire or absorb from 800 to 1,000 mm. of water per ha. annually.[5]

Under the arid climate of Tripoli, physiological evaporation from eucalyptus or acacia plantations on sandy ground (not to mention physical evaporation, which is obviously proportional to the water content of the soil) must normally require water supplies other than rainwater, or the vegetation would suffer and die. Fortunately dew helps. The condensation of water vapor at night has not been studied thoroughly, at least quantitatively; as a matter of fact, condensed dew is difficult to measure. Some observations indicate that certain types of vegetation, particularly forest crops, draw from the atmosphere as much dew water as rainfall.

In any case, there must be some water equilibrium in Tripolitania, since dry cultivation is possible in areas where the rainfall is only 200 mm. Also, many plants, particularly desert plants, can draw water from the sand through their roots from depths of 5 and 6 m. or more; others spread their runners over 20 sq. m.

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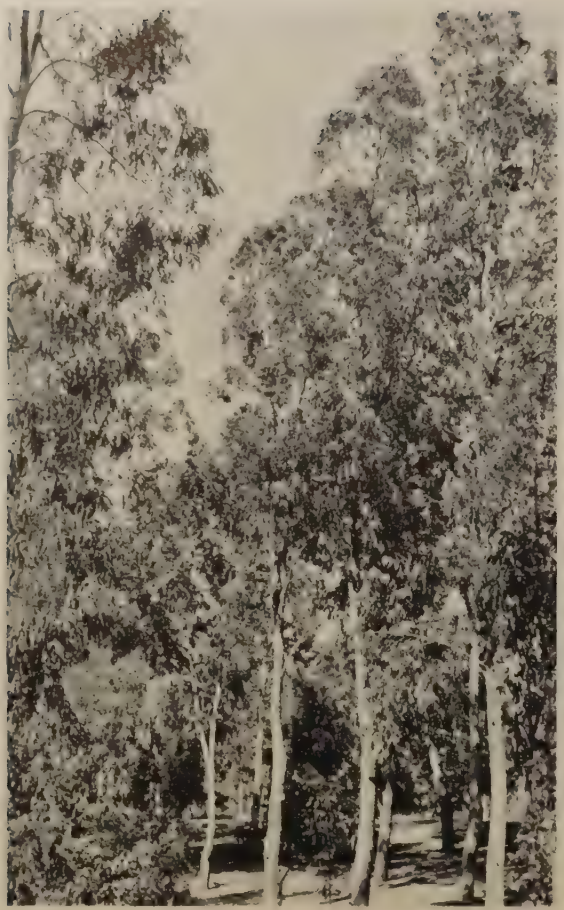
[5] For comparison purposes, the following figures are cited by Furon (*L'érosion du sol* [soil erosion], Raymond Furon, Paris 1947) from Keilhack and other authors, for evaporation under the temperate climate of Europe:

Coniferous forest: 0.5-1 mm. per day up to 300 mm. annually.

Cereal crops: 2.2-5 mm. per day, or for 4 months of active growth: 270-600 mm. annually.

Meadows with grasses and clover: 2.1-7.3 mm. per day, or for 8 months of active growth: 500-1,000 mm. annually.



*Eucalypts may provide one of the solutions to Tripoli's afforestation problems. This grove in the state forest at Hascian shows how well they do. The white stem on the rights is that of* E. rostrata, *behind it being several* E. gomphocephala. *The trees are 18 years old, spaced 5 × 5 m.*

or more. In Tripoli, some eucalypts growing alongside roads have roots 65 m. long. This suggests that trees should be planted very far apart, as in the forest reserve of *Acacia tortilis* at Gasr-el-Hag. *Acacia cyanophylla* should be planted at a maximum rate of two plants per *Dis* cellule or 800 to 900 plants per ha. With eucalyptus on stable, sandy soils, only 150 plants per ha. should be used, spaced 8x8. No attempt should be made to cover the site uniformly. In Tunisia, on the dunes of Garmath, where the climate is more humid than in Tripoli, young *A. cyanophylla* plantations were formed with twice or three times the number of plants per hectare here suggested, that is 2,000 - 2,500 plants. The plantations now look like dense, barely penetrable thickets and are entirely different in appearance from the stands in Tripolitania, where the trees are well spaced and compact, having adapted themselves to the aridity of the area. The struggle for existence plays a very important role in these regions.

*Conclusions*

A study of Tripolitania's problems of afforestation and sand-dune fixation leads to conclusions which are valid for all arid countries. In a country like Tripolitania it would clearly be folly to try to create a complete forest canopy, or to plant up whole areas uniformly. Furthermore, the species chosen for afforestation and sand fixation must be both frugal with water and drought-resistant, and it would appear that the use of many of the Australian acacias and eucalypts will provide the best solution of the problem.

Among the former, experiments might well be undertaken with *A. cyclops, A. picnantha* and *A. mollissima*, with emphasis on tannin production. The two last might do well in the coastal areas; another Australian species worth trying is *A. aneura*.

Of the eucalypts, *E. gomphocephala* has already proved useful in this area. Other species suggested for trail include *E. cladocalyx* and *E. sideroxylon* for all arid soils; *E. occidentalis* for humid, salty soils, and *E. astringens* because of the quality and high tannin content of its bark. *E. salmonophloia* might be tried on clayey soils, *E. brockwayi* on muddy soils, *E. oleosa* on sands, and *E. saligna* on deep, moist soil. There are, possibly, other species which might also be used and about which information can be found in existing literature.

Our present state of knowledge is insufficient to enable us to calculate scientifically the extent to which afforestation is possible. But it is certainly safe to say that nature will quickly efface any imprudent, over-ambitious schemes.

*Readers of the above article will be interested in an article on "Afforestation in Arid Zones", by M. Metro, which will appear in the next issue of* UNASYLVA. *Reference should also be made to M. Metro's paper, "Ecology of Eucalypts", which appeared in No.* XLIX *of the proceedings of the Society of Natural Sciences of Morocco, Oct.* 1949. *A study tour to enable foresters of arid zone countries to observe eucalypts in their natural environment has been organized by FAO, to take place in Australia, Sept.* 1952; *finally, a study of eucalypts is also being prepared by M. Metro for FAO.*

# Private Forest Management in the American "Lower South"

by William A. Duerr and W. E. Bond
Southern Forest Experiment Station, U. S. Forest Service

More than thirty percent of the commercial forest land in the United States lies in the lower South. In this great forest domain there is an unparalleled opportunity to observe the operations and problems of private management, since about nine-tenths of the land is privately owned. The high level of productivity of much of this area, the abundance of logging and wood-using activities, and the contrasts from one locality to the next are all remarkable. In addition to great variety, the region is characterized by an excellent network of main and secondary roads which, by rendering these southern upland forests very accessible, aids vitally in their management and exploitation.

To study the region's various aspects let us assume a tour starting in the toe of Louisiana and southern Mississippi, thence moving north and east across the shortleaf and loblolly (*Pinus echinata, P. taeda*) pine-hardwood uplands of Mississippi, Tennessee and Alabama. Turning south, through Georgia and Florida, we then go westward through the longleaf (*P. palustris*) and slash pine (*P. caribaea*) forest which borders the Gulf Coast.

The second half of the tour, west of the Mississippi River, starts in the longleaf pine belt in southwest Louisiana and southeast Texas, and proceeds through shortleaf, loblolly pine-hardwood uplands in Texas, Oklahoma, Louisiana, and Arkansas. Finally, starting in northeastern Arkansas, we travel south to New Orleans through the hardwood and cypress groves of the Mississippi bottomlands, or along virtually the whole length of a belt called the "Delta," which runs from Cairo, Illinois, to the Gulf of Mexico.

### *A Vast Private Forest Enterprise*

Bogalusa, Louisiana, is the center of perhaps the largest private forest plantation in the world. There, the Gaylord Container Corporation has a huge pulp and paper plant which consumes more than a thousand cords of pulpwood daily, supplying paper for a number of ancillary manufacturing plants. Forestry on these holdings goes back to 1920, when the Great Southern Lumber Company, which was merged with the present owners in 1937, began a great program of reforestation on its cutover longleaf pine land. By 1937 it had hand-planted 30,000 acres (12,000 hectares) to pine—chiefly slash pine but some longleaf and loblolly. By keeping out fire and leaving seed trees, many thousands of acres of cut-over land have been restocked naturally. Since 1937 the planted area has been increased to 68,000 acres practically all within 15 miles of the pulp mill.

The forests are handled by 14 graduate foresters and some 40 trained woodsmen. The forestry crews have the most modern equipment: mechanical tree planters, a fleet of jeeps, two-way radios, a fire-patrol airplane, and complete facilities for taking and interpreting aerial photographs. Through their efforts, and aided by the South's favorable soil and climate, recently-acquired cut-over lands are already assuming the appearance of productive forests. There can be found 21-year-old plantations of slash pine averaging 32 cords of standing timber per acre (202 $m^3$ per ha.) which have already yielded 9 cords per acre in thinnings.

While the company's policy is to keep its plant supplied with pulpwood, it also seeks to make as large a profit as possible by cutting the mature trees into the most valuable products they are capable of yielding. Thus, the company sells 15½ million board feet (70.2 million $m^3$) of pine sawlogs and piling and 15¼ million feet (69 million $m^3$) of hardwood logs and ties annually, and gets three-quarters of its pulpwood, not from its own lands, but by purchase from small forest owners.

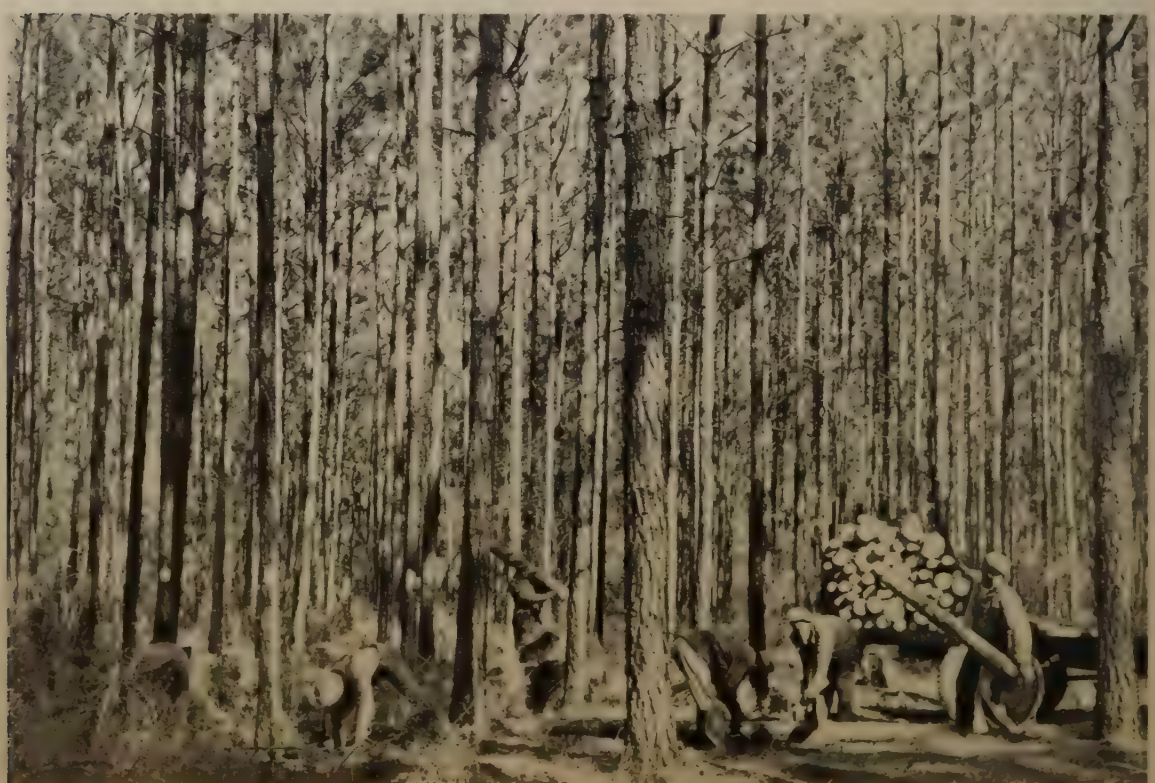
### *Forestry Extension and Assistance*

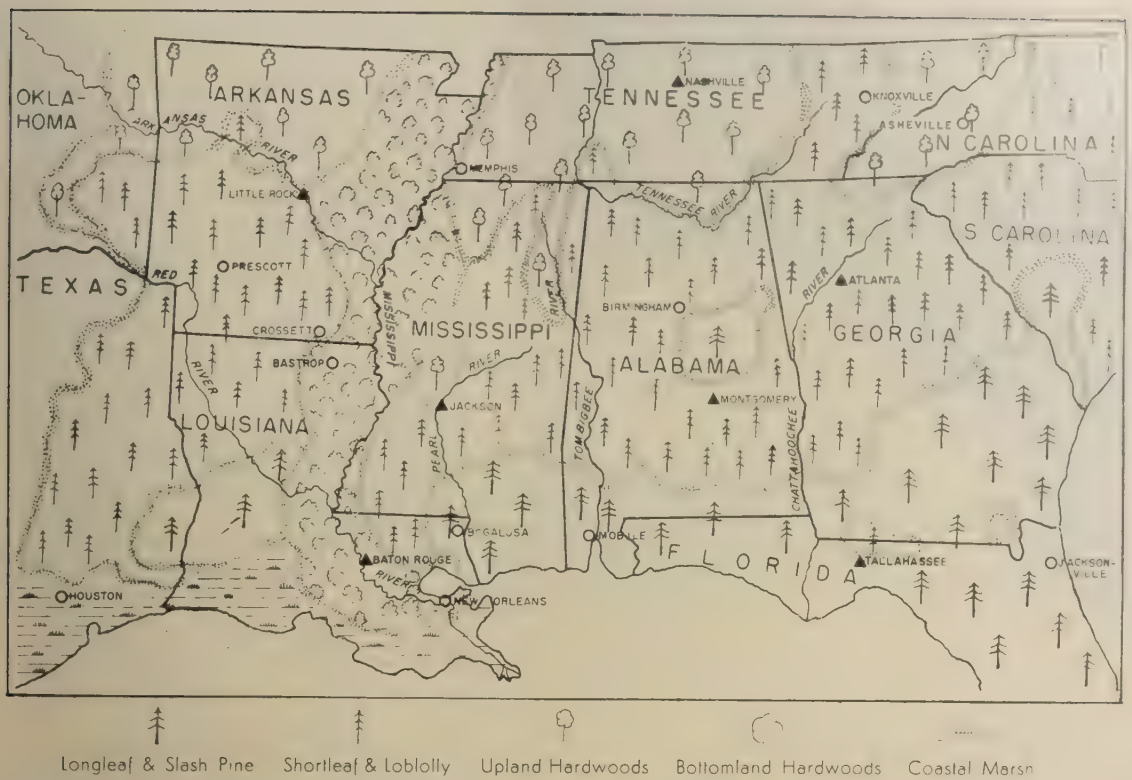
Leaving this area, we travel north through characteristically interspersed woods and farm lands, from which the pulp and paper plants and the sawmills obtain much of their wood. Many of these woodlands show signs of recent heavy cutting, and are stocked mainly with low-grade hardwood and with pine too small to be usable. What prevents the large companies from using conservative cutting practices on these farmlands?

Part of the difficulty is that the owner of the small woodland often insists on, or because of small volumes is forced into, selling all marketable timber. Again, over two-thirds of the cuttings are made by or for wood users who have no constructive policy. Furthermore, even those wood users who have constructive policies may exert little direct control over the activities of timber cutters on lands other than their own. In the case of pulp companies, for example, cutting is done by contractors, not by company employees.

To eliminate this condition, progressive companies must approach the owners of these woodlands through forestry instruction and technical assistance. Most pulp companies and some lumber companies and large contractors devote part of the time of their forestry staffs to this purpose. The pulp industry, through the Southern Pulpwood Conservation Association, and the lumber industry, through the Southern Pine Association and the Southern Hardwood Producers, Inc.,

*These two photographs give some idea of the fine forests produced under private management in the Lower South. Above is a typical stand of pine, while below, a routine thinning operation is in progress in a slash pine plantation. Ten cords per acre are being removed, twice that volume left for further growth.*






*This sketch map of the area covered by our article gives a good idea of the wide range of types of forest found in the Lower South. Conifers predominate, with a great belt of hardwoods up the bottomlands of the Mississippi Valley.*

supplement the efforts of other private bodies and of state and Federal agencies in an expanding program to persuade and assist woodland owners to practice conservative management. This program still has far to go.

### *Cutting Practices on Small Holdings*

Small holdings (taken to be less than 5,000 acres) comprise seven-tenths of the private forest land in the lower South. A survey made in 1945 by the U. S. Forest Service showed that good cutting is practised on only 2 percent of these holdings. Since then only moderate improvement has been made. These holdings, both farm and nonfarm woodlands, are the crux of the timber-management problem in this region. The majority of the owners, have little or no investment in wood-using plants, and sell their produce on the open market. Their holdings are the principal scene of activity of an army of itinerant loggers, contractors, and small sawmill operators.

Some small owners, however, do practise good cutting. For example, the owner of a 25-acre woodland in Bullock County, Alabama, has netted $1,038 in money and lumber from six sales of standing timber during the 31 years he has been managing his land. This means an average income of $33.50 a year from 25 acres (10 ha.) of timber land, or about $1.35 per acre ($3.34 per ha.) a year. In addition, he has cut several hundred dollars worth of fence posts for his own use. Today he can still show a good stand of pine and hardwoods; his forest is growing rapidly and will probably triple its present volume within the next 10 years. Although he was never taught to select the trees to be cut, he marked those he thought should be felled and recently called in the local farm forester to help him improve his cutting practices.

For every small property like this one, there are dozens where timber-cutting practices have been poor or destructive. A great number of the owners or operators of these woodlands are unaware that their woods can produce a high, regular income if well managed. Others are too occupied with farming or other business to have time for forestry. Still others have sold all their marketable timber because they needed the cash; often they accepted the first offer without knowing the amount or value of their timber.

### *Cutting Practices on Large Holdings*

In 1945, three-fourths of the total acreage of well-cut forest properties in the lower South was in holdings of more than 50,000 acres. The prime interest of many large owners in the region is to stay in business. Their forests are their source of raw material — in many cases for the present, in all cases for the future, when the open market may not be so ready a source of wood as it is now. The 1945 Forest Survey showed that 75 percent of pulp-company land and 50 percent of the large lumber company holdings were being handled

*There are some 15,000 sawmills the in Lower South, of which this is one of the larger examples. Between them, they turn out three-tenths of the United States' lumber production. Below is a typical scene on the Mississippi, where barges are used to get big logs to the riverside sawmills. Across the river rise new generations of cottonwood and willow.* (U. S. Forest Service photographs).

with good cutting practices. Since then spectacular progress has been made in improving practices on large holdings.

One example is that of the Tennessee Coal, Iron, and Railroad Company, of Birmingham, Alabama. This company has 275,000 acres of forest land. About four-fifths of it is in northern Alabama, in shortleaf, loblolly and longleaf pines and hardwoods. The remainder consists of longleaf and slash pine forest in southern Alabama. A considerable part of the timber cut from the north Alabama forests is used in company mining and manufacturing operations. By using low-grade hardwoods in these operations, the more valuable pines are saved. From its longleaf-slash pine forest in south Alabama, the company is removing all diseased and damaged trees, and then thinning the remaining stand to provide space for future growth. The principal product is sawlogs, with pulpwood being taken from tops and thinnings. All company forests are protected from fire. A chief forester and five assistant foresters mark the timber and manage all company forests for highest sustained returns.

*Fire Protection*

One of the great handicaps to private forest management in the lower South has long been the fire problem. Some of the chief remaining gaps in the nation-wide system of state-federal co-operative fire protection are in the lower South. The Forest Service's 1945 survey found that only 32 percent of the privately owned commercial forest land in the lower South received good or fair fire protection up to the official minimum standard.

The protected forest acreage, which in 1945 was 63½ million acres rose, however, to over 95½ million in 1950 but much forest is still unprotected. Fire protection is a job best handled on a large scale. The absence of good public protection, while serious for all, is harder on small owners than on large, who are able to supplement the public system with one of their own.

*Wood Utilization*

East of the Mississippi it is said that 10 to 20 cents out of every dollar in the pockets of southerners come from the forest. Though not a precise figure, it gives some idea of the great importance of wood to this area. As a source of income, forests produce about half as much as farming, and in fact many towns in the Lower South are largely supported by some sawmill or pulp mill or other wood-using plant. Along the road, countless trucks can be seen bearing sawlogs, pulpwood and lumber, and at many railroad sidings these forest commodities are being loaded on cars. In rural areas loggers are busy everywhere, and near the woods there are small sawmills by the hundred. In all there are some 15,000 sawmills in the Lower South — the great majority of them small — which produce three-tenths of the entire lumber output of the United States. The region's 42 pulpmills utilize over 40 percent of all pulpwood produced and turn out more than a third of the country's wood pulp.

The region's forests are not well enough stocked or managed to support all this activity on timber growth alone. From the mid-1930's to the mid-1940's, total sawlog growing stock fell 14 percent. This repres[illegible] a drain on timber capital.

*Development on a Large Holding*

To assure future wood supplies, many companies are purchasing large timber blocks and building up the growing stock on them. One of the largest of these holdings is that of the Southern Kraft Division of the International Paper Company. All told, Southern Kraft owns about 2½ million acres (1 million ha.) of timber land in 9 southern states. Slash (*Pinus caribaea*), longleaf (*P. palustris*), shortleaf (*P. echinata*), and loblolly pines (*P. taeda*) and hardwoods at all stages of growth from reproduction to large saw timber, are included. The company's nine large pulp and paper mills consume about 3½ million cords (8.9 million $m^3$) of pulpwood annually — about a third of the total pulpwood cut in the South and nearly a fifth of the country's total requirements.

In 1925 the Southern Kraft Division was organized and began to practise forestry. Today, its forestry staff includes 155 technical foresters. Company land is being intensively managed, but because of very conservative cutting it is currently providing less than 10 percent of total pulpwood requirements. The Division's chief concern on these lands is to improve growing conditions and to build up the growing stock. A system of 217 lookout towers, radio-equipped control crews, several thousand miles of telephone lines, ploughed fire lanes, and fire access roads, has enabled the various state fire control agencies and the company to reduce fire losses considerably. Only one percent of the company's holdings burns over annually.

Thousands of acres of pine have been released from over-topping scrub hardwoods. Dense young pine stands have been thinned. Hardwood sawlogs have been cut and sold to make room for pine on a quarter-million acres (100,000 ha.). The Division has begun a 10-year planting program for 40,000 acres (16,000 ha.), planting about 4 million seedlings each year with machines. Southern Kraft furnishes annually over 100 million board feet (453 million $m^3$) of pine and hardwoods from company land to other forest industries and local wood users.

Southern Kraft foresters also do educational work with forest owners from whom pulpwood is purchased. Each year they mark, without charge, about 240,000 cords (612,000 $m^3$) in partial cuttings on about 80,000 acres (32,000 ha.) belonging to several hundred forest owners. In addition, the company holds exhibits and conservation meetings and distributes annually more than 3 million pine seedlings free for planting by 4-H Club boys, Future Farmers of America, and landowners.

*The Hardwood Problem*

The hardwood problem, to which the Southern Kraft foresters devote a good deal of their attention, is widespread in the South. On pine sites, unpromising hardwood may reproduce vigorously and threaten to take over the stand.[1] Many hundred thousand acres

[1] See *Unasylva* Vol. V, No. 3, p. 107 - "Loblolly Pine," by Thomas Lotti and R. D. McCulley.

that were formerly pine forest are now hardwood forest. Both here and on hardwood sites, the poorer-quality hardwood tends to increase in the stand as better elements are harvested. The only remedies are to find uses for this poor hardwood or to destroy it.

The Ozan Lumber Company, at Prescott, in southwestern Arkansas, has made a particularly aggressive attack on the hardwood problem. This company has about 120,000 acres (49,000 ha.) of shortleaf-loblolly pine (*Pinus echinata - P. taeda*) and hardwood land. It operates three efficient medium-size sawmills and produces chiefly pine lumber. The logs for these mills come both from company land and from outside purchases. The company has employed a forester for about 15 years and has been cutting conservatively and selectively. Much of the poor-quality hardwood of sawlog size was utilized during World War II. Since then a 15-man crew, working under the forester, has utilized or girdled hardwoods on most of the Company's land, and thinned many young pine stands for pulpwood. This crew has also been available to mark timber for cutting on the land of other forest owners without cost. The company has donated numerous small tracts to be developed as school forests.

*Forest Research*

Research work is an important part of the forestry movement in the lower South. Forest research is well advanced with the development of improved wood-utilization procedures, the study of tree regeneration and cultural measures, the use of advanced techniques in gum naval stores production, and in the development and demonstration of profitable systems of timber management.

This research is being done by both private and public agencies. Among the latter are the Southern and South-eastern Forest Experiment Stations of the U. S. Forest Service. From their respective headquarters at New Orleans and Asheville, North Carolina, these two stations operate 12 branches in the lower South. One of the most important branch stations is that at Crossett, in southern Arkansas. The findings of 16 years of research at this branch have had a marked effect on loblolly (*Pinus taeda*) and shortleaf pine (*P. echinata*) management throughout the South.

Especially noteworthy as an example of intensive management is the "farm forestry forty" on Crossett's Experimental Forest. Set up as a trial of what a farmer might earn from his woods through annual selective cutting, the 40-acre (16 ha.) plot has now been under management for 13 years. During that period, 161 M board feet (729,000 $m^3$) (Doyle rule) of logs, 294 cords of pulpwood (750 $m^3$), 228 cords of fuel wood (483 $m^3$), and 418 fence posts have been cut. These products had a value, on the stump, of $2,851 ($5.48 per acre [$13.54 per ha.] annually). The timber stand has improved and the forest today is in far better condition than when cutting started.

On about 1,000 acres (400 ha.) of the Experimental Forest selective timber management under short cutting cycles has been practised for 10 years. During this period an average of 1,755 board feet (7,950 $m^3$) (International 1/4-inch rule) of pine logs has been cut per acre. Despite this, the average volume per acre in pine trees of sawlog size increased from 4,800 board feet (53,730 $m^3$ per ha.) before cutting started in 1937 to 6,253 board feet (70,000 $m^3$ per ha.) after cutting in 1946. This is an increase of 30 percent in volume, in addition to the 37 percent of original volume that was cut during the 10-year period.

Land for the 3,500-acre experimental forest was made available by the Crossett Lumber Company. This company now employs 23 foresters in carrying out intensive management on a sustained yield basis on 550,000 acres of shortleaf and loblolly pine and mixed hardwoods. The marking service is also offered to farmers. Crossett, a pleasant city of 10,000 people, is sustained by the company's pine and hardwood sawmills, pulp and paper plant, hardwood distillation plant, and wood preservation plant, all utilizing the timber harvested from company and farmer-owned land.

*Bottomland Forest Management*

Although there is more hardwood timber than pine in the lower South, far more is known about the management of pine than of hardwood in this region. Hardwood forestry remains a challenging problem. The one great section of the lower South where pine is quite out of the picture is the Delta, which is the floodplain of the Mississippi River.

One of the progressive forest owners in this area is the Anderson-Tully Lumber Company of Memphis, Tennessee. This company, a pioneer in managing hardwoods, owns more than 200,000 acres (80,000 ha.) of bottomland forest, including one of the few remaining large areas of highgrade bottomland old-growth hardwood timber. It is one of the largest producers of hardwood lumber and veneer in the country. Most of its high-grade logs are cut from company lands, but many quality logs and most of the common timber is purchased from farm woodlands and other open-market sources. Besides logs, it purchases much green lumber.

To be profitable, hardwood operations must produce a large proportion of high-grade lumber which will meet the requirements of furniture and other factories. Accordingly, when old-growth bottomland hardwood became scarce some years before the last war, the company began selecting the over-mature and damaged old-growth trees for cutting and saving the thrifty ones for future cuts. In cottonwood stands, for example, no sound trees below 28 inches (71 cm.) dbh were cut. The company now practises very strict selective cutting of old growth, removing only those trees that would probably diminish in quality or die before the next cut, in 5 to 10 years. Similarly, the damaged and low-grade younger trees are utilized for lower grade products and the cleanest, thriftiest trees of the most valuable species are managed for future yields of high-grade logs. A crew of about 10 trained men spends full time in cruising, appraising, and marking both company and outside timber. Woods fires, which are especially harmful to hardwoods, are strictly controlled, and reproduction of the valuable species after logging is very successful. The chief aim of management is to assure adequate supplies of high-quality logs in order to keep future production of all plants up to present capacity.

*Forestry Prospects*

What does the future hold for private forest management in the Lower South?

One thing is certain; if the success of private forestry depends upon such factors as rapid timber growth, ample labor supply, and ready access to wood-using plants and markets, then the lower South offers outstanding opportunities for private forestry. Another point is fairly certain; the past trend toward good management on large forest holdings will continue. But what of the small forest owners? To this critical question there is no clear answer. Thus far large-scale promotion efforts to instruct small owners in forest management have not induced many to practise good forestry, and as yet educational and technical assistance programs have not had a great effect on small forest holdings. Small owners, however, hold the majo[illegible] the forest lands, and probably always will. Thei[illegible] ings are too important to the public and to industr[illegible] be dismissed.

In view of its heavy reliance on these small forests, can industry reform the cutting practice it uses in harvesting wood from them? What shape would such reform take? Regulation by law? Or, would it be better to follow exclusively the education and assistance approach? Is some sort of forest credit needed? What are the possibilities of small owners banding together into co-operative associations for forest management and timber processing? These are urgent questions, not only in the lower South of the United States, but in many other countries as well. On their solution depends the future prosperity of a great many people.

# The Forest Situation in Colombia

by M. van BOTTENBURG
Lately FAO Forestry Adviser to Colombia

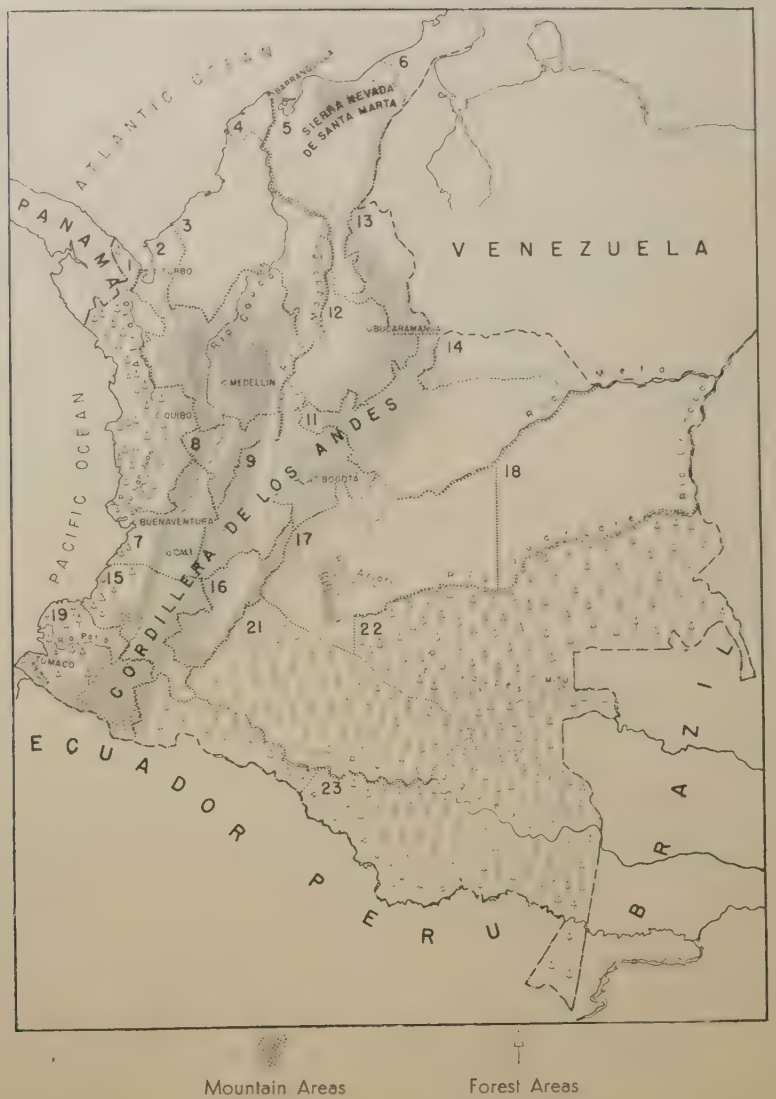
THERE is a striking similarity in the forest histories of many Central and South American countries. The situation in these countries can be traced back to common historical, economic, and social roots. This is worth the effort, since a knowledge of this common background will lead to a better understanding of present conditions and will help to point the way to improvement.*

Four centuries ago the Spaniards and Portuguese colonized Central and South America on a large scale. The type of colonization was definite settlement, and the newcomers succeeded in making this part of the Western Hemisphere almost completely Spanish or Portuguese speaking. But at the time the first emigrants from the Iberian peninsula settled what has since come to be called Latin America, the forestry awakening in Europe had not yet taken place. The importance of forest cover in relation to soil conservation and water supplies was not understood nor was the economic significance of forests appreciated. A sense of responsibility for keeping intact the fertility of the soil grew up first in central Europe, and from there the idea spread to northern Europe where forestry became, in time, an integral part of the national economy. Later on, the northern colonizing powers began to spread this new knowledge about forests and proper forest care in Africa and Asia. Spain and Portugal, however, had no such chance in Latin America, because the colonies became independent before the mother countries had themselves become forest conscious.

After achieving their independence, many of the new Latin American republics went through frequent periods of political unrest and instability. This, too, was clearly not favorable to forestry development, which needs continuity of purpose and of government policy.

Another fundamental similarity in the forest history of Latin American countries relates to land tenure and the distribution of landed property. The early settlers took the best lands by force, while others, at a later stage, acquired special grants from the mother governments. The description and registration of these settlements and grants were always vague; it was not until the rise in population forced land values up that the proper mapping and registration of properties seemed necessary. Even then the definition of rights was confined to comparatively limited areas and today rural land tenure is still vague and uncertain particularly in the zones of major interest from the point of view of forestry. Moreover, such rights of property as do exist are not very well protected for lack of rural police. Insecurity of tenure and lack of clear titles do not encourage landowners to take care of their lands; hence the general, almost complete, absence of proper agricultural methods to prevent loss of fertility. Forests have been regarded as any man's land, and it has more often than not been considered meritorious to cut and burn them, irrespective of their value, in order to obtain more room for food crops and pastures. Since systematic forest management — as a consequence of its long-range character — is practically impossible without security and continuity of ownership, the chances for forestry development under such conditions have been very poor indeed.

* See also — *The Forests of Colombia and some of their Industrial Possibilities*, Proceedings of the United Nations Scientific Conference on the Conservation and Utilization of Resources. Volume V, Forest Resources. (U. N. publication no: 1950 II.B.6.)




Mountain Areas  Forest Areas

*Key to Departments etc. of Colombia:*

1 Chocó
2 Antioquia
3 Bolívar
4 Atlántico
5 Magdalena
6 Guajira
7 Valle del Cauca
8 Caldas
9 Tolima
10 Cundinamarca
11 Boyacá
12 Santander
13 Norte de Santander
14 Arauca
15 Cauca
16 Huila
17 Meta
18 Vichada
19 Nariño
20 Putumayo
21 Caquetá
22 Vaupés
23 Amazonas

*As the map shows, Colombia has a good deal of its area under forest, while other vast tracts are mountain country. The latter are much eroded, but were formerly covered with forest, while in the southeast corner of the country is a great area of virgin tropical forest, a potential source of great wealth if properly developed.*

A third circumstance common to many Latin American countries was that the immigrants had a strong preference for living in the hills and mountains, where they found a mild climate and conditions for cattle-breeding and crop cultivation similar to those at home. In this respect, incidentally, there is a remarkable difference between Far Eastern tropical areas and those of the Western Hemisphere. Whereas, for instance, prosperity in Indonesia and Ceylon is based on production between sea-level and 500 m. altitude, 70 percent of Colombia's population lives and works between 500 and 3,000 m. above sea level. Consequently the pressure on mountain forests with soil protecting and water regulating functions has been much more dangerous in tropical America than in most Far Eastern tropical countries.

A fourth factor influencing the forest situation was the settlers' cattle-raising system, which required extensive pastures in the most fertile, level valleys between the mountains. The original inhabitants were forced to seek croplands on the hill slopes. This led in many cases to most unsatisfactory land use; the best agricultural lands were retained for grazing by the big landlords, while crop cultivation was restricted to lands most unsuited for agriculture. Population increase forced the small holders ever higher up into the mountains, and thus a deforestation process set in to the prejudice of the fertility of the soils. The "slope farmers" became poorer and poorer. There was no alternative; they had to cut and burn higher forest or starve with their families.

The combined results of all these influences are clearly evident in the present forest situation in Colombia.

### *Features of Colombia*

Colombia lies in the extreme northwest of South America, between 4° South and 12° North, with its shores washed by both the Pacific and Atlantic Oceans.

The topography is characterized by the fact that the high Cordillera de los Andes splits in the south of the country into three separate mountain chains, running almost due south to north and forming the Cordillera highlands, with peaks over 5,000 m. high. Between the Cordilleras the big Magdalena and Cauca rivers flow from south to north to the Caribbean Sea.

The country can be roughly divided into four parts, namely the mountain chains described above, the Pacific coast area, the northern plains including the Caribbean coast area, and the vast plains east of the Andes.

Due to its topography, Colombia features almost all the climates of the world. Temperatures range from tropically hot in the lowlands to below freezing point on the snow-capped mountain peaks. Humidity and rainfall show endless variations according to differences in temperature and position of the mountain ridges in respect of wind direction.

Colombia's forests show the same rich variation and of the country's 1,139,000 sq. km. approximately 45 percent is still under forest. This seems very impressive, but unfortunately most of these forests are quite inaccessible.

*The Highlands*

Seventy percent of Colombia's 12 million people live in the mountainous part of the country, an area of about 260,000 sq. km. These highlands, which should be expected to have from 20 to 25 percent of their area under protective forest cover, are almost completely bare. Four centuries of uninterrupted deforestation and faulty agricultural methods have brought the land into a desolate state, with all the scars and bruises of ill-treatment revealed. The highlands are, in fact, dying lands. Dangerous surface and gully erosion increases at an alarming rate. Landslides, inundations, and silt cause tremendous damage. Reservoirs for hydroelectric schemes tend rapidly to become useless, endangering many industries. Water supplies to population centers are becoming more and more inadequate and irregular. The fertility of the soils and their crop-growing capacity are decreasing day by day; in fact some parts of the highlands, once prosperous agricultural areas, have become virtual deserts.

The last remnants of forests in the highlands consist of scattered patches in inaccessible places, extending certainly over not more than 4,000 or 5,000 sq. km. They are all of the highest protective value and should be maintained intact; this would still leave the highlands short of about 6 million ha. of any suitable type of protective vegetation.

This situation means that nearly three-quarters of Colombia's population are living in a timberless region. The productive forests are far away in the lowlands, and transportation to the population centers is a complicated and expensive business with all the possible commutations of mule-trucks-railway and river transport. Sawn timber is shipped by sea from Tumaco to Buenaventura, and thence transported by truck to Bogotà over two cordilleras. The transportation costs are 200 pesos per ton,[1] and amount to about two-thirds of the selling price. In fact timber and firewood prices in the highlands are exorbitantly high and actually out of the reach of the ordinary man. Substi[illegible] used wherever possible, but lack of wood ham[illegible] solution of the housing problem and helps augm[illegible] the cost of living. Obviously reforestation in [illegible] highlands with commercial species would be a most profitable business.

[1] 1 US $ = 2.50 pesos.

*East of the Andes*

Between the Andes and the frontiers of Venezuela, Brazil, Peru and Ecuador are some 600,000 sq. km. of very sparsely populated lowlands, which form the catchment area of numerous affluents of the Orinoco and Amazon rivers.

This region can be roughly divided into two parts:

1. The northern part, about 200,000 sq. km., consisting of the districts of Arauca, Casanare, Vichada and part of Meta, contains the vast semi-arid, savannah-like grass plains (llanos). Forests on these plains occur along the riverbanks and in scattered patches all over the region, totalling perhaps some 40,000 sq. km.

2. South of the Río Guaviara the districts of Vaupés, Caquetá, Putumayo, and Amazon as cover together 400,000 sq. km. About 375,000 sq. km. of this region are said to be one enormous tropical forest jungle, about which little is known. Logging is carried out only in places where truck roads from the mountains penetrate far enough into the jungle; here, however, extraction is limited to the high-class timbers, such as *Tecoma, Swietenia, Cedrela,* etc. The jungle contains an abundance of wild *Hevea* trees, which are being tapped in some localities. The rubber is brought by the local collectors to assembling points on the rivers, such as Mitú on the Río Vaupes, and flown by hydroplane to the consumption centers in the uplands.

For the bulk of these forests east of the Andes the only economic form of transportation seems to be by rafting along the big rivers which flow to the east through still vaster untouched forest concentrations in the drainage areas of the Orinoco and Amazon, and thence to the sea. But these forest preserves are complete labor vacuums, and the chances of large-scale timber operations seem for the time being hopeless.

*The Northern Plains*

The districts Bolivar, Atlantico, Magdalena and Goajira districts are lowlands, with the exception of the isolated mountain massif of the Sierra Nevada de Santa Marta, with its 5,800 m. Pico Cristóbal Colón.

The western part of the lowlands are more densely populated and sparsely forested. The southeast and central part, where the Cauca river flows into the Río Magdalena, is characterized by lakes and swamps and larger forests. The southern half of the district of Magdalena is mainly farmland with scattered forest remnants, from which the better-quality species have long since been logged. The west and south slopes of the Sierra Nevada de Santa Marta are deforested and badly eroded; the north and east slopes are in better shape. Some of the north slope forests extend down to the coast in several places. The Goajira peninsula has an arid climate, and still possesses considerable *Libidibia* stands, exploited for divi-divi tanning bark for home use and export.

*In Colombia, as in most Latin American countries, forestry is more than usually bound up with soil conservation, and this photograph shows the sort of problem involved. The scene is at Yomasa, 2,640 meters up, near the forest nursery of La Picota, 5 km. south of Bogota. Deforestation followed by over-grazing and faulty agricultural methods has led to erosion as bad as this over vast areas of the country... and how bad it is may be gathered from the size of the man, of average height, standing in this desolate scene.*

As far as existing waterways and truck roads have allowed, all the forests of the departments of Bolivar and Magdalena have been logged repeatedly to supply the bigger Barranquilla sawmills and the smaller local ones. What is left is non-marketable wood of the softer hardwood types, such as Ceiba (*Hura crepitans*) and Caracoli (*Anacardium excelsum*). These scattered forest patches could be profitably logged again only if these species proved suitable for papermaking.

*The Forests in the Central Magdalena River Valley*

Lack of communications has enabled of Río Magdalena Valley between La Dorada and Gamarra to escape from intensive farming and deforestation and there are in this region about 10,000 sq. km. of large mixed forests. The composition seems to be quite satisfactory; preliminary timber cruising in the Río Tecorama showed several places with more than 300 $m^3$ of marketable timber per hectare. Most abundant are softer hardwoods including Caracoli (*Anacardium excelsum*), Jobo (*Spondeas mombin*), Ceiba (*Hura crepitans*), which can be used in fiberboard manufacture and are now being tested for their suitability for pulping. Concentration of timber per ha. and the configuration of the terrain are good enough to justify mechanized logging operations, and in fact the forests are attracting the interest of local and foreign capital. From the economic point of view, these Magdalena forests are the most promising in Colombia. But many areas in

this region can be converted into crop lands or pastures. If this happens, the forest would have to be cleared entirely.

*The Pacific Coast Area*

The 800-km.-long lowland strip between the Western Cordillera and the Pacific Coast is Colombia's most important productive forest reserve. It is only 30 km. wide near Buenaventura, but it widens considerably both north and south of that point, so that its average width is about 80 km. The climate is hot and humid. The annual rainfall, more than 3 m. near the coast, increases rapidly higher up in the foothills, where the forests are always damp. Still higher up the slopes the precipitation exceeds 10 m. per year in several places. This exceptionally high torrential rainfall naturally increases the erosion danger. The dangers of deforestation can be seen wherever the population from the central highlands has passed over the Cordillera to occupy the western slopes; an example can be found west of the mountain pass Mares, west of Cali, where extraordinarily rapid erosion quickly brought an end to coffee planting and fruit orchards.

The existing data about the forests in Choco, lower Valle, lower Cauca, and lower Narino indicate forests of quite satisfactory composition, with an estimated total forested area of 55,000 sq. km.

South of Buenaventura the many small rivers and two larger rivers, Río Patía and Río Mira, all flow straight to the ocean. Between Buenaventura and the Panama frontier there are low hill ridges along the coast, forcing the rivers Río San Juan and Río Atrato to flow respectively north to south and south to north. Both rivers provide ample opportunity for cheap timber transportation, and the conditions for mechanized logging are favorable in many areas.

Along the coastline from the Ecuador frontier to the north there is a valuable strip of tidal mangrove forest (*Rhizophora mangle*), 300 km. long and 5 km. wide. The mangrove bark is the raw material for the national tannin industry at Buenaventura, and there is also some export of dry bark to the United States.

The Pacific Coast region needs a thorough forest survey to ascertain the possibilities for forest industries. Although many of the soils in this area are suitable for perennial commercial crops, such as oil palms and cacao, forest industries might very well serve as pioneers to attract new concentrations of population. Since the area is thinly populated only large-scale industries could afford to invest in the housing, medical care, and other facilities which would be needed to attract new labor.

As a matter of fact, domestic and foreign capital are becoming increasingly interested in the Pacific Coast forests. A large project is underway in the Tumaco region, where a Colombian industrialist, working with U. S. capital, will start logging and sawmill operations, combined with cacao plantations. For this industry the building of a road to connect Diviso and Tumaco will be of the utmost importance.

In the Río Juradó, too, near the Panamanian frontier, a timber cruise will probably be carried out in 1952 by a private concern.

*Present Timber Production*

There is no export of wood products from Colombia. On the contrary, several products must be imported since the country has no pulp, plywood or fibreboard industries of its own. Annual imports of paper and paperboard reach a value of 8 to 10 million pesos.

The coastal sawmills and the resawmills in the consumption centers together may produce 200,000 $m^3$ of sawn timber a year. The bigger sawmills in Tumaco and Barranquilla — with bandsaw breakdowns — have an output of 1,000 $m^3$ per month (15,000 board feet per day); the smaller, portable mills do not produce more than an average of 100 $m^3$ per month. The amount of handsawn timber produced is unknown; it must be considerable since transportation difficulties hamper the moving of logs and favor handsawing in the forest itself. Wood preservation is unknown as yet.

*Forest Problems*

The authorities in Colombia are well aware of the fact that the rehabilitation of protective forest cover in the highlands, the creation of new forests near the centers of population, and the development of logging and woodworking industries in the accessible lowland forests are urgent matters. They are faced, however, with problems of bewildering proportions.

A well-organized, well-staffed governmental forest service is needed with ample operation funds; but this would take many years to organize. Land classification has to be carried out, and the areas to be dedicated permanently to forests and put under management have to be set aside; this, too, cannot be done quickly. Six million ha. in the uplands should be brought under some sort of protective vegetation, which means the shifting of populations elsewhere, the opening up of new areas, and altogether considerable organization. Forest protection requires a strong forest act and vigorous law enforcement.

Moreover, forestry is only one of several other interrelated activities. For both agriculture and forestry, reasonably reliable topographical maps are required for land classification. Without proper meteorological information, reforestation would be risky. An expanded forest service, operating without benefit of government agencies working in related fields which were equally advanced, would be almost useless.

The Government started some years ago a thorough study of the complex situation. Advisory assistance was obtained from the International Bank for Reconstruction and Development, and a start was promptly made on the development program which the Bank proposed. From FAO, Colombia obtained a forestry adviser to make an over-all survey of the forest situation and put forward specific recommendations.

Some of the suggestions of this adviser were put into effect last year. A new forestry faculty for the training of forest officers was established as an annex to the existing agricultural faculty at Medellin, and it is hoped that this Medellin college will develop into a valuable training center which will also stimulate forest research. The existing rudimentary forest service has been given more staff and better accommodation. A large-scale reforestation project has been started in the watersheds of the Río Neusa, where a

dam has been built for hydro-electric power and for water supply to the city of Bogotá. Finally, an intensive propaganda campaign has been started against the burning of forests.

The development of the lowland forests in Colombia has been described as promising, but this will not provide any immediate revenue to help the financing of highland rehabilitation. The reason is that within the very near future the uplands will be overpopulated, and an outlet will have to be found in the less agreeable zones of the country. The lowlands will have to be gradually opened up, made healthy, and developed agriculturally. Part of the forests will have to be cleared for this purpose, and the timber removed could feed new forest industries while permanent areas of productive forests were being defined and taken under management. But special privileges would have to be accorded to capital, whether national or foreign, for opening up these areas, and it seems unlikely that any substantial revenues would accrue for at least ten years.

Much more promising from the point of view of revenue would be reforestation in the uplands, if, during the first ten years, nothing but commercial tree crops were grown. Although the present high levels of prices for timber, poles and firewood would certainly drop somewhat as yields increased, they would probably remain high for at least 25 years. Any large-scale commercial reforestation would, of course, have to be carefully planned and organized; even so, it would be a compromise with theoretical conservation requirements. From this standpoint places most in need of reforestation should be planted only with those species and crops which have the highest protective value. Such an ideal, however, would cost the country too dear, and the first new plantations should strive to combine the protective and productive functions. They should be in areas near enough to consumption centers to permit profitable exploitation of thinnings and a guaranteed final yield for sawn timber, or pulp wood. The species planted would have to be rapid-growing, such as *Eucalyptus* and *Pinus* species, even though these are not ideal for conserving or restoring soil cover. However, as commercial reforestation spread over the highland region, gradually the revenues would come in and at a later stage counter-balance the expenditures; ultimately it could provide the best source of income for conservation work elsewhere, especially in remote places where profitable selective cutting could hardly be expected and where clear cutting could not be allowed.

This does not mean that the higher slopes should be neglected; action in the remoter areas must, however, initially be confined to closure and protection. If the slopes are left alone, a natural cover of grasses and shrubs will gradually establish itself as a preliminary protection. This would improve soil conditions and facilitate reforestation proper at a later stage.

Lack of reliable basic data makes it very hard to plan a specific sequence of actions. But there are certain emergency steps, already known in Colombia, that must be taken to shield the country from what otherwise may be sure disaster. There is thus quite a struggle ahead for a generation of foresters, but proper forest care and development are of such vital importance that they deserve the whole-hearted support of every responsible citizen, until gradually forestry becomes a reality in the minds of the people at large.

# Plans for the Austrian Sawmill Industry

By Åke Simonsson, FAO Technical Assistance Officer in Austria

A radical program is now under way to modernize Austria's long-established sawmill industry. To Austria, and to its traditional export markets in other European countries, the fact that there was no technical and industrial development in the sawmill industry during the war and postwar years has been a matter for serious concern. Today, with the aid of counterpart funds accruing from Marshall Plan dollar credits, a planned approach has been mapped out to switch over from old to modern methods, based on the proposals made by the FAO mission for Austria in 1950.

The importance of the industry to Austria is obvious when one considers that no less than 38 percent of the land area of the country is under forest. The total amount derived from forestry and forest products accounts for roughly 9 percent of Austria's gross annual income. In the international market, Austria ranks third, after Sweden and Finland, as an exporter of sawn wood. Last year the country exported about 2.37 million m³, a slight increase over 1950.

Austria's significance as an exporter of sawn timber derives in part from the fact that its highly industrialized neighbors require large quantities of timber for further processing. Italy, long a traditional market, absorbs at least 50 percent of Austria's sawn wood exports. Other important outlets are Germany, Switzerland, and the Mediterranean countries. In addition to its continental neighbors, Austria is now finding markets in areas overseas where softwood supplies are short. Austria's sawn timber is particularly in demand in foreign markets because of the dimensions it can supply.

These substantial exports naturally have their effect on the supply available for domestic use. For example, the exceedingly competitive market conditions caused by external demands have made it difficult for domestic

woodworking industries to satisfy their own requirements at reasonable prices. Because of this, only very little of the sawn timber produced this year is expected to be used by domestic secondary industries. Of the 1,005 million schillings' worth of sawn wood remaining, the bulk will probably go for export.

Sawmilling is the oldest of all the woodworking industries in the country, and, while other industries (such as wood pulp and wallboard manufacture) are increasing in importance, it remains the largest consumer of roundwood. The 1952 estimates envisage a total consumption of raw timber worth 868 million schillings. Of the 2,874 million schillings' worth of finished and semi-finished goods to be produced, substantially more than a third will be in the form of sawn wood.

*The Investment Program*

In its program to reorganize the sawmill industry along modern lines, Austria is striving to effect reforms without interfering with current production, economic stability or labor, and particularly without waste of capital. The effort to re-equip and to modernize the industry is part of a long-range plan embracing all of the major industries concerned with wood and wood products. This plan, involving extensive investments and subsidies, was proposed by the FAO Mission for Austria, working in conjunction with the Austrian administration and with the U. S. Economic Co-operation Administration.

The following investment figures suggest the scope of the plan:

| | Millions of schillings |
|---|---|
| Sawmilling | 157 |
| Manufacture of containers and crates | 14 |
| Prefabricated houses and parts | 4 |
| Furniture industry | 20 |

In order that the production of standard construction parts and furniture should develop along modern lines, the modernization and expansion of other wood-using industries is also essential. Investment plans therefore also cover the following industries:

| | Millions of schillings |
|---|---|
| Wallboard manufacture | 123.8 |
| Plywood and panels | 29.5 |
| Veneers | 3.0 |

Of the 157 million schillings proposed for the sawmill industry, 80 millions are to be spent in a three-year period, according to the present approved investment program. For an industry with an annual production of over 1,000 millions this can only be considered an initial step, and new means of financing must be found in the future.

*Reorganization Problems for the Sawmill Industry*

For centuries sawmills were the only significant primary forest industry in Austria. The problems it faces in reorganization are, therefore, far more complicated than those of relatively much younger industries. The industry is characterized by a large number of small, independent units. There are few highly capitalized mills supplied with the latest equipment such as exist elsewhere in Europe.

In all, Austria has 6,000 sawmills with approxima 2,400 complete frame saws and 3,800 single frame saws The theoretical processing capacity is 8 to 9 million n of roundwood, but the maximum efficiency is only 45 to 50 percent. This low utilization is chiefly due to the fact that a large number of mills are operating only on a part-time basis, manufacturing sawn wood for local use. They are owned by farmers, proprietors of small forest tracts, who run their mills only when water is abundant and labor is not more profitably employed elsewhere. The large number of these local mills is due to the physical character of the country, with its numerous narrow valleys between high mountains. Many areas are, indeed, still partly inaccessible, which renders the transport of logs to central industries extremely costly and difficult.

In working out the modernization plan, it was seen that an effort to modernize the many small mills would only result in serious social and political difficulties, and the idea was therefore abandoned. The program is instead confined to large mills producing sawn timber on an industrial scale for home use or export. But even here loans are being granted only to selected firms operating sawmills of various types and sizes which can serve as models for the others. Some of the newly-built mills have been visited by workers from all parts of the country.

*School for Sawmill Workers*

Firms within the sawmill industry are being encouraged to work together to their mutual advantage. Co-operation of this type is a characteristic of the American lumber industry, and has also played a significant part in the postwar reconstruction of Finland's industry. In Austria, credit for the foundation of a school for sawmill workers is due principally to an association recently set up by the industry to solve common problems. Financed by ERP credits, this school will fulfill the functions carried out in other countries by the big industries themselves. Besides teaching new methods and techniques to workers, it will test the latest types of machinery, so that sawmill owners can learn what modern equipment would best suit their purposes.

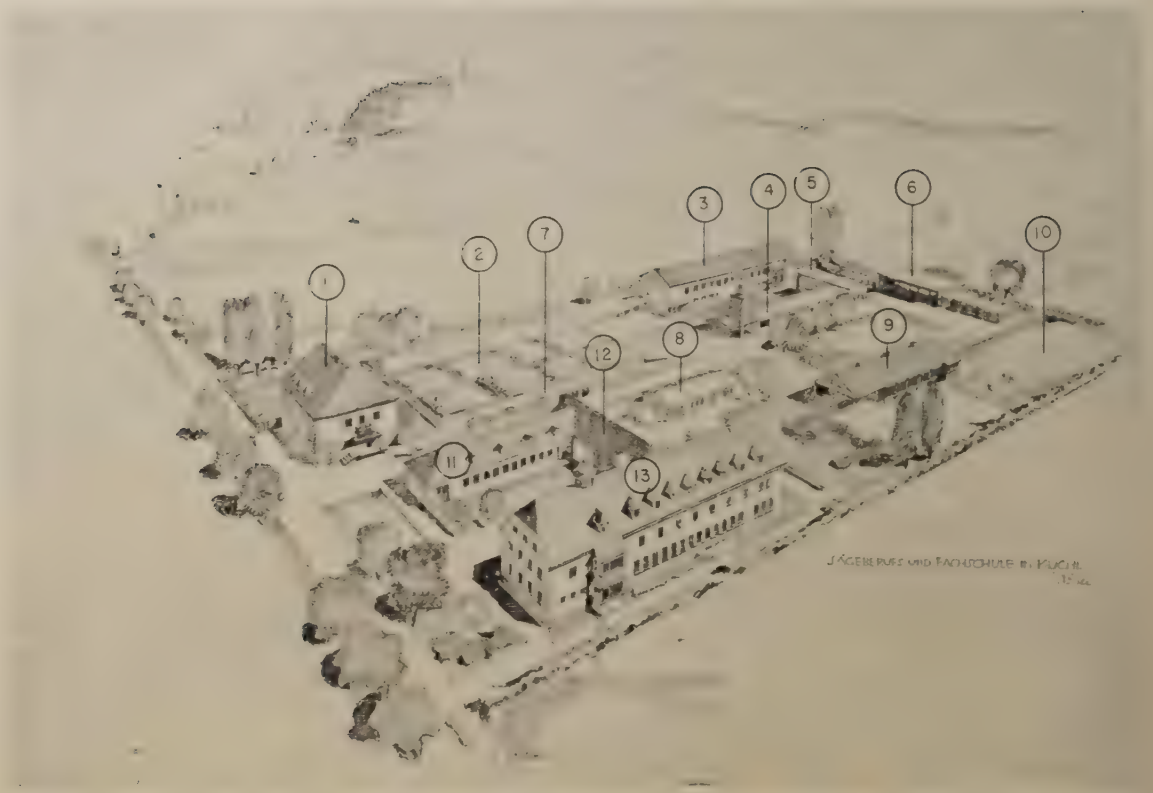
The courses and training facilities of this school are to be as follows:

1. *A Technical Training School for sawmill workers,* providing the following courses of instruction;

(*a*) *Three-year apprenticeship.* When the experimental sawmill has been completed, a training school will be opened giving 3-year courses for 45-60 apprentices. Apprentices will be admitted when they have finished their elementary education and will be given a complete theoretical and practical training in sawmill techniques.

(*b*) *Course for supervisors and foremen.* After passing an examination for skilled workers and completing a year's practical experience, selected men can take advanced training in preparation for a supervisor's certificate.

(*c*) *Industrial and commercial course.* Such a course is compulsory by Austrian law for every sawmill




*The drawing above shows a schematic view of the proposed new sawmilling school being established in Austria. The numbered buildings, etc., are as follows: 1, experimental station; 2, log yard; 3, experimental sawmill; 4, planing mill and drying kilns; 5, sorting works; 6, lumber yard; 7, ramp; 8, students camp (additional living quarters); 9, experiment shed; 10, playing filed; 11, teaching workshop; 12, engine shed; 13, main building.*

apprentice. During his 3 years' apprenticeship every man must complete an 8 weeks' commercial training course. The annual number of students will be approximately 300.

(*d*) *Special training courses.* Advanced courses intended to provide information on experiments and new sawmilling techniques to experienced workers, as follows:

15 one-week courses for skilled sawmill workers
4 one-week courses for sawmill managers
5 one-week courses for foremen and graders
4 one-week courses on work organization and efficiency
5 one-week courses on book-keeping and calculation

Each course will cater for 25 students, and further courses, meetings and lectures will be provided as necessary. There will, therefore, be around 35 training and special courses attended annually by between 800 and 900 pupils.

2. *A testing and experimental institute for sawmilling techniques.*

This will be a government institute for sawmilling techniques; it will form part of the school and hence have the benefit of the experimental sawmill, the machine pool and the teaching facilities.

3. *A complete sawmill* for instruction and experiments.

4. *Students' lodgings.*

This has accommodation for 100 apprentices and is equipped with a technical and scientific library, and a study with a radio and film projector. In addition, there are lodgings for students attending the special courses, as well as for guests.

This school should prove a great boon to concerns which have obsolescent equipment and no funds to cover depreciation costs, since by taking advantage of the school's facilities, these concerns should be able to raise their productivity by as much as 20 percent without additional capital investment. The school can show these firms how to improvise with their existing equipment (for example, how to accelerate the speed of a frame saw). They should thus be able to compete with the most modern mills in their own localities.

This program for modernization of the Austrian sawmill industry does not require the widespread erection of new plants. There are, of course, substantial arguments for such a move: lower production costs, with a better quality product; the possibility of a more efficient use of waste by the pulp and wallboard industries, and of shortening the period between felling and the arrival of timber at the sawmill. But in an industry which has so firm a structure, innovations must be introduced by degrees, taking care that the machinery and power plants now in use are not rendered obsolete too quickly.

# *Commodity Report*

## European Pitprop and Pulpwood Supplies

The availability of pitprops in Europe is closely connected with that of pulpwood, since to some extent the two are interchangeable. This report is a study of the supply position of both, though data on pulpwood, particularly on production and stocks, are rather scarce. In addition to tracing the post-war developments in supplies of small industrial roundwood — a term which covers both commodities — it describes the changes which have occurred in the relationship between the two commodities involved.

Since the war, structural changes which may become permanent have taken place in the intra-European trade of small industrial roundwood. Before the war 50 percent of western Europe's import requirements came from eastern European countries, but in the postwar period only about 10 percent of all western European roundwood imports have come from eastern Europe.[1] Last year, the figure stood at 6 percent.

This change has led to increased domestic production in most western European countries except France and Western Germany. Immediately after the war, French import requirements (particularly of pulpwood) were met by large deliveries from Western Germany, whose own requirements were then far below the prewar level. This situation naturally changed when Western German coal production was gradually raised to practically the prewar level and the pulp industry was rapidly rebuilt. All deliveries to France and other western European countries were discontinued, and at the same time Western Germany re-entered the international market as a potential importer. This development hit France severely, particularly since forest fires during the postwar period had destroyed large forest areas, notably in the Landes, one of the main softwood producing regions of France. Thus from 1950 onwards the European market felt the growing pressure of both French and Western German requirements, which had been practically absent in the earlier postwar years.

### *Requirements and Availabilities*

In general, European production and imports from North America and other sources have sufficed to meet the growing needs of Europe's coal and pulp industries. Critical periods in supplies have been short-lived. Supplies of pitprops, more important to most countries than pulpwood, have been secured without great difficulty for most species of softwoods and even hardwoods can be used in mines. In France, for example, some 23 to 24 percent of all pitprops used are hardwoods. Where pulp industries are concerned, the situation is different. For them, the most valuable raw material is spruce, which is becoming increasingly difficult to obtain in sufficient quantities. The sulphite pulp industries, dependent on spruce, have had trouble in meeting their needs, especially in importing countries, at the same time that pine pulpwood, the much more abundant primary raw material for sulphate pulp, has been available for the asking. Whereas great efforts have been made to utilize spruce supplies fully, potential supplies of pinewood cannot be completely utilized until there are more mills. Shortages of pulpwood supplies in the importing countries have generally meant, therefore, shortages of spruce pulpwood. Statistics do not differentiate between spruce and pine, but the whole picture of the entire international trade in small industrial roundwood is colored by the supply of, and demand for, spruce pulpwood.

The shortage of spruce pulpwood in the international market affects the price levels for other categories and species, including pine. The reason for this is that the supplies of pine form a common category with those of spruce. This situation does not obtain in domestic markets, where price of spruce may vary considerably from those of pine pulpwood.

Another factor in the European pulpwood supply situation is the increasingly important contribution from "woodwaste" of which wide use is already being made in the northern countries. By following this lead, other European countries could substantially supplement existing roundwood supplies.

By 1951, total production in Europe (excluding the U.S.S.R.) had climbed up to 52.5 million m³, only 2.4 million m³ below the 1935-1938 average. The changes in the past three years can be seen in Table 1.

TABLE 1. — EUROPEAN PRODUCTION OF PITPROPS AND PULPWOOD

(Millions of cubic meters)

| | 1951 | 1950 | 1949 | Average 1935-1938 |
|---|---|---|---|---|
| *Pitprops*: | | | | |
| Western Europe . . | 10.9 | 10.3 | 10.8 | 12.1 |
| Eastern Europe [1] . . | 3.8 | 3.7 | 3.9 | 2.7 |
| Total . . | 14.7 | 14.0 | 14.7 | 14.8 |
| *Pulpwood*: | | | | |
| Western Europe . . | 32.3 | 25.2 | 30.6 | 36.5 |
| Eastern Europe [1] . . | 5.5 | 5.6 | 4.9 | 3.6 |
| Total . . | 37.8 | 30.7 | 35.5 | 40.1 |
| Grand Total [2] . . | 52.5 | 44.7 | 50.2 | 54.9 |

[1] Excluding the U.S.S.R.
[2] Total production in 1951 and production in eastern Europe in 1949-51 are estimated.

[1] Czechoslovakia, Eastern Germany, Hungary, Poland, Rumania, and the U.S.S.R.

This table shows that European pitprop production has remained fairly stable, reflecting the continuous demand for coal. The production of pulpwood on the other hand has been subject to greater changes, being sensitive to the relatively greater fluctuations in demand for pulp and paper. Even here, the variations have been due almost entirely to changes in Sweden and Finland, which are Europe's main exporters of wood pulp and pulp products, the latter being also Europe's main pulpwood exporting country. Pulpwood production in other European countries remained more or less stable.

The importance of the Swedish and Finnish production of pulpwood to the total European production is clearly shown in Table 2.

TABLE 2. — PULPWOOD PRODUCTION IN SWEDEN AND FINLAND [1]

(Millions of cubic meters)

| | 1951 | 1950 | 1949 | Average 1935-1938 |
|---|---|---|---|---|
| Sweden | 12.6 | 9.5 | 13.8 | 14.7 |
| Finland | 10.5 | 7.5 | 6.4 | 7.6 |
| Total | 23.1 | 17.0 | 20.2 | 22.3 |
| Total Europe | 37.8 | 30.7 | 35.5 | 40.1 |

[1] 1951 figures are estimates.

This table also shows the remarkable elasticity of pulpwood production, which appears to be able to follow demand with ease. It is not known to what extent producers do, if prices are high enough, cut more than is advisable from the silvicultural point of view.

The decline in the production of pulpwood in 1950 followed from the rather unfavorable market conditions for pulp products all over the world, but no doubt was also due in part to strong competition from the sawmilling industry in that year. In fact, while the weak demand for pulp and paper brought about a fall in prices of small roundwood in 1950, prices of sawn wood remained very high and even increased. Consequently, producers sold their roundwood to the sawmills whenever possible.

Finnish production of both pitprops and pulpwood has been influenced by conditions on export markets to a far greater extent than elsewhere in Europe. This explains the wide variations in Finnish production from year to year. Swedish production, on the other hand, has been influenced mainly by domestic demand, which seems to have varied considerably from year to year according to the stocks situation and the demand for pulp and pulp products. When in 1950 the market for Swedish wood pulp and pulp products was particularly unfavorable, stocks of pulpwood increased beyond expectations. Despite this, the rising demand for pulp and pulp products in 1951 led again to high demand for pulpwood and a further rise in prices to attract new supplies.

The changes in the production of pulpwood and pitprops in Europe by countries can be seen in Table 3.

TABLE 3. — PRODUCTION OF PITPROPS AND PULPWOOD.

| Country | Pitprops | | | | | | Pulpwood | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1952 Forecast | 1951 Actual | 1951 Forecast | 1950 | 1949 | Average 1935-38 | 1951 | 1950 | 1949 | Average 1935-38 |
| | (1000 m³) | | | | | | | | | |
| Austria | 395 | 289 | 403 | 272 | 323 | 170 | 1 455 | 1 153 | 1 102 | 2 025 |
| Belgium | 800 | 800 | 725 | 800 | 750 | 750 | 200 | 150 | 100 | 14 |
| Finland | [4] 1 500 | [4] 1 122 | 850 | [4] 880 | [4] 1 134 | [4] 1 700 | (11 500) | 7 520 | 6 350 | 7 600 |
| France | 2 520 | 2 100 | 2 140 | 2 285 | 1 800 | 2 400 | 1 630 | 720 | 700 | 780 |
| Germany (Fed. Rep.) | 2 600 | 3 504 | 2 900 | 3 157 | 4 057 | [2] 1 420 | (2 320) | 1 674 | 2 623 | [2] 6 080 |
| Ireland | (14) | (14) | 14 | (10) | 9 | 10 | — | — | — | — |
| Italy | 125 | 135 | 125 | 115 | 115 | 130 | 470 | 253 | 219 | 300 |
| Luxembourg | 40 | 78 | 60 | 46 | 90 | 150 | — | — | — | — |
| Netherlands | 100 | 108 | 90 | 101 | 80 | 150 | 22 | — | — | — |
| Norway | 100 | 60 | 50 | 50 | 101 | 250 | 3 800 | 3 070 | 4 314 | 3 880 |
| Portugal | 290 | (240) | 240 | 200 | 212 | 450 | (53) | (53) | (53) | 25 |
| Spain | (800) | (800) | 800 | (800) | 800 | 700 | (400) | (400) | (400) | 10 |
| Sweden | 825 | 342 | 340 | 268 | 200 | 250 | 12 650 | 9 500 | 13 800 | 14 660 |
| Switzerland | 10 | — | — | — | — | — | (390) | 250 | 370 | 277 |
| Turkey | 70 | 109 | 68 | 88 | 63 | 100 | (25) | 68 | 22 | 20 |
| United Kingdom | 676 | 634 | 630 | 674 | 599 | 130 | (115) | 14 | 14 | • |
| Yugoslavia | 520 | 446 | 550 | 622 | (728) | 800 | (450) | (500) | (560) | 800 |
| TOTAL | 11 385 | 10 781 | 9 985 | 10 363 | 11 061 | 12 060 | 34 890 | 25 325 | 30 627 | 36 471 |
| Czechoslovakia [3] | 725 | 725 | 725 | 800 | 750 | 700 | [1] 1 760 | [1] 1 760 | 1 700 | 2 200 |
| Eastern Germany [3] | 1 000 | 1 000 | 1 000 | 1 000 | 1 200 | [2] .. | 2 090 | 2 090 | 1 500 | [2] .. |
| Hungary [3] | 200 | 200 | 200 | 200 | 200 | 100 | .. | .. | .. | .. |
| Poland [3] | 1 800 | 1 800 | 1 800 | 1 700 | 1 700 | 1 800 | 1 500 | 1 500 | 1 500 | 1 200 |
| Romania [3] | 50 | 50 | 50 | 50 | 50 | 100 | 200 | 200 | 200 | 200 |
| U.S.S.R. [3] | 16 500 | 16 000 | 16 000 | 16 000 | 16 000 | 13 000 | 5 000 | 5 000 | 4 000 | 7 000 |
| TOTAL | 20 275 | 19 775 | 19 775 | 19 750 | 19 900 | 15 700 | 10 550 | 10 550 | 8 900 | 10 600 |
| TOTAL EUROPE | 31 660 | 30 556 | 29 760 | 30 113 | 30 961 | 27 600 | 45 440 | 35 875 | 39 527 | 47 071 |

Figures in brackets are estimated by the FAO Secretariat.

[1] Exports as production. [2] Germany of 1938. [3] Production of pitprops and pulpwood in the eastern European countries is estimated by the FAO Secretariat. — [4] Planned average 1949-1953.

*Pitprops*

No statistics are available to show the total consumption of small industrial roundwood in Europe but there seems to have been a steady increase since World War II, and consumption is now nearing the prewar figure. Fairly reliable statistics are available for pitprops indicating a general development of this nature during recent years. A fact to be noted is that pitprop consumption in Europe has not increased in proportion to coal output. This reflects the efforts made in most European coal producing countries to economize in mine timber by employing more efficient techniques. For example, in 1938, coal production in Europe was 570 million tons and pitprop consumption about 16.6 million $m^3$. In 1951 approximately 580 million tons of coal were produced, using only 15.5 million $m^3$ of pitprops. The average consumption of pitprops in Europe per 1,000 tons of hard coal produced was 26 $m^3$ in 1951, as against 27.2 $m^3$ in 1947 and between 29 and 30 $m^3$ in 1938.

Stocks of pitprops were unusually high at the end of 1949 but declined in all countries in 1950. In 1951, though a few countries raised stocks, there was a further general decline, and by the end of the year stocks in France and the U. K. were lower than at the end of 1950.

Table 4 shows the movement of stocks of pitprops in some of the most important European coal-producing countries.

TABLE 4. — STOCKS OF PITPROPS IN SOME EUROPEAN COAL-PRODUCING COUNTRIES [1]

| Country | 1951 | | 1950 | | 1949 | |
|---|---|---|---|---|---|---|
| | 31 Dec. | 30 June | 31 Dec. | 30 June | 31 Dec. | 30 June |
| | (1000 $m^3$) | | | | | |
| Belgium | 643.7 | 354.2 | 570.0 | 610.1 | 727.5 | 645.8 |
| France | 822.6 | 934.4 | 1 505.4 | 1 588.6 | 1 752.2 | 1 161.7 |
| Germany (Fed. R.) | 611.2 | 552.3 | 581.5 | 640.5 | 701.9 | 678.1 |
| Italy | 7.0 | 7.3 | 7.0 | 5.3 | 6.2 | 11.5 |
| Netherlands | 138.5 | 90.1 | 147.7 | 151.7 | 155.1 | 158.0 |
| Saar | 109.1 | 117.1 | 214.6 | 242.1 | 242.0 | 242.5 |
| United Kingdom | 1 300.0 | * 950.0 | 1 660.0 | *1 800.0 | 2 178.5 | 1 853.0 |
| TOTAL | 3 632.1 | 3 005.4 | 4 686.2 | 5 038.3 | 5 763.4 | 4 750.6 |

*Source:* UN Economic Commission for Europe, *Monthly Bulletin of Coal Statistics*

[1] Including sawn mining timber. * Secretariat estimates.

An important reason for the decline of pitprop stocks last year was that the considerable price increases for pulpwood forced pitprop prices above the levels that the coal mines were prepared to pay. The mines therefore drew heavily on their reserves. Toward the end of the year, when pulpwood prices weakened, most of the coal-producing countries were able to remedy their pitprop stock situation by placing large contracts with the exporting countries.

*Pulpwood*

Although no statistics on consumption and stocks of pulpwood are available, it is clear that consumption has rapidly increased since the end of the war. The strong demand for wood pulp and pulp products has led to expanded production in most countries, and has also prompted the construction of new pulp m[illegible]. Even so, the consumption of pulpwood in Europe [illegible] not reached the prewar level, estimated at some 47 mi[illegible]lion $m^3$ annually. It varied around 35 and 40 million $m^3$ a year in the 1946-50 period, and probably reached some 43 million $m^3$ in 1951, including stock building.

Last year's favorable market conditions for pulp and paper caused a rapid drain on the pulpwood stocks of most European countries in the first half of the year. Later, stocks at pulp mills were replenished, and were generally believed to be very satisfactory at the end of the year. This good stock position and the consequent decline in demand were the main factors which caused pulpwood prices to fall at the beginning of 1952.

*Trade*

The structural changes in the European trade of pitprops and pulpwood are clearly shown in Table 5.

*Imports.* A steady increase in Europe's imports of pulpwood *vis à vis* pitprops has taken place since the war. In 1951 total European imports of pitprops were 2.6 million $m^3$, a slight increase over 1950 but still well below the figure of 4.1 million $m^3$ reached in 1949, the record postwar year. Imports of pulpwood, on the other hand, showed a marked increase in 1951, when they reached 5.6 million $m^3$ as against only 2.9 million $m^3$ in 1950 and 4.1 million $m^3$ in 1949.

The main reason for this development has been that normally importing countries have given relatively greater priority to coal production and hence encouraged the production of pitprop supplies from domestic sources. As a result, pulpwood supplies from domestic sources had to take second place, and the pulp industries which had been expanding rapidly were forced to rely more heavily on imports.

The increase in pulpwood imports is not a phenomenon limited only to the countries where coal mines and pulp industries are competing. Some of the traditional roundwood producing countries, notably Sweden and Norway, in 1951, imported unprecedented quantities of pulpwood. There were various reasons for this. In Norway, the decline in the productive capacity of the country's forests as a result of earlier overexploitation made it necessary to import more pulpwood in order to meet the growing requirements of the paper industry. In Sweden, the latest forest inventory showed a substantial decline in the productive capacity of forests in the northern parts of the country, where the bulk of the Swedish pulp industries are situated. These industries were therefore forced either to get increased supplies from southern Sweden where the forest inventory had shown an increase in productive capacity, or to import from northern Finland. They chose the latter alternative, as supplies from this source were in many respects more cheaply accessible.

Elsewhere in Europe, the dominant feature has been the steady increase of pulpwood imports by western Germany. They roughly doubled each year from 1949 to 1951, in line with the rapid reconstruction of the western German pulp and paper industry. German forests immediately after the war supplied large quantities of both pitprops and pulpwood to neighboring

TABLE 5. — EUROPEAN IMPORTS AND EXPORTS OF PITPROPS AND PULPWOOD

| Country | 1951 | | | | 1950 | | | | 1949 | | | | Average 1935-38 | | | | Imports and Exports |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pitprops | % | Pulpwood | % | Pitprops | % | Pulpwood | % | Pitprops | % | Pulpwood | % | Pitprops | % | Pulpwood | % | |
| | (1000 m³ rounded) | | | | | | | | | | | | | | | | |
| U. S. S. R., Poland, Czechoslovakia, Romania and Eastern Germany | 21 | 1 | 334 | 6 | 24 | 1 | 211 | 7 | 107 | 3 | 296 | 11 | 167 | 1 | 510 | 7 | [1] Imports |
| | 304 | 11 | 186 | 4 | 448 | 18 | 170 | 6 | 324 | 8 | 39 | 1 | 1 992 | 39 | 4 119 | 67 | [2] Exports |
| Northern European countries | * | — | 1 393 | 25 | * | — | 707 | 24 | — | — | 500 | 18 | 2 | * | 491 | 6 | Imports |
| | 1 504 | 58 | 3 674 | 72 | 1 172 | 46 | 2 139 | 70 | 1 897 | 43 | 1 273 | 47 | 1 928 | 37 | 1 830 | 22 | Exports |
| Other European countries | 2 602 | 99 | 3 750 | 69 | 2 401 | 99 | 2 069 | 69 | 3 988 | 97 | 1 926 | 71 | 4 582 | 96 | 6 507 | 87 | Imports |
| | 775 | 27 | 436 | 9 | 865 | 34 | 637 | 21 | 1 444 | 33 | 1 347 | 49 | 938 | 18 | 400 | 7 | Exports |
| TOTAL EUROPE | 2 623 | 100 | 5 477 | 100 | 2 425 | 100 | [3] 2 926 | 100 | 4 095 | 100 | 2 722 | 100 | 4 751 | 100 | 7 508 | 100 | Imports |
| | [3] 2 582 | 91 | [3] 4 295 | 85 | 2 485 | 98 | [3] 2 947 | 97 | 3 665 | 84 | 2 659 | 97 | 4 858 | 94 | 5 879 | 96 | Exports |
| Canada and other countries to Europe | 262 | 9 | 767 | 15 | 62 | 2 | 93 | 3 | 710 | 16 | 81 | 3 | 300 | 6 | 274 | 4 | Exports |
| GRAND TOTAL | 2 623 | 100 | 5 477 | 100 | 2 425 | 100 | * 2 926 | 100 | 4 095 | 100 | 2 722 | 100 | 4 751 | 100 | 7 508 | 100 | Imports |
| | 2 844 | 100 | 5 062 | 100 | 2 547 | 100 | 3 040 | 100 | 4 375 | 100 | [3] 2 739 | 100 | 5 158 | 100 | 6 153 | 100 | Exports |

[1] Imports from western European countries only, as reported by the exporting countries in western Europe, for the years 1949-1951. — [2] Exports to western European countries only, as reported by the importing countries in western Europe, for the years 1949-1951. — [3] Not exact sum of the listed figures, which have been rounded off. — * Secretariat estimates. –

countries; cutting at the same rate could not be continued. Since the coal mines were of a far greater importance to the economy of the country than the pulp industry, the demands of the latter soon exceeded the limited domestic supplies with the result that raw material had to be imported.

France, immediately after the war, had been able to meet all its requirements by deliveries from Germany. When these were discontinued, the country's own resources could not at the same time meet the requirements both for pitprops and pulpwood, and the country became increasingly dependent on foreign supplies.

Imports of pulpwood in 1951 into both Switzerland and the Netherlands were high, to take advantage of the favorable pulp and paper market, at a time when domestic stocks of pulpwood were nearly exhausted. Imports of pulpwood into Italy have shown a steady rise since 1949, due to the good marketing prospects for wood pulp, exports of which have steadily increased.

Imports of both pitprops and pulpwood by the United Kingdom were higher in 1951 than in 1950. Imports of pulpwood have shown a steady increase since the end of the war, but imports of pitprops have been rather irregular. Thus, in 1951, they were higher than in 1950 but considerably below the 1949 figures. The irregularity of pitprops imports has caused rather difficult supply situations from time to time, most of which, however, have been overcome. Despite Britain's substantially increased import level last year, it was still far below the programmed target of 2,270,000 m³. It seems possible that large quantities contracted for last year have not yet been delivered, and that imports in 1952 will be greater, improving the stock situation.

It is difficult to account for the relatively large postwar imports of pulpwood by the U.S.S.R. from Finland. They were not war reparations but were purchased under regular trade agreements. They were said to be destined for pulp industries in the Leningrad region, where there was a local shortage of industrial wood which could most easily be remedied by supplies from Finland. Whatever the explanation, high prices were certainly paid for the supplies.

Imports of pitprops and pulpwood are given in Table 6. The volumes shown as imported by the eastern European countries are the export totals reported by the western European exporting countries, since no direct statistical data are obtainable from eastern Europe.

*Exports.* At the end of Aug. 1951, the ECE Timber Committee estimated the total export possibilities of pitprops from European countries, as well as from Canada and the United States to Europe, at some 3,450,000 m³ of which about 3,050,000 m³ were to come from Europe. Actual exports appeared in fact to be close to these estimates: an estimated 400,000 m³ from eastern Europe to other eastern countries, 2,560,000 m³ from western European countries and 262,000 m³ from Canada and the United States, or a total of 3,220,000 m³. While most countries exported quantities close to the estimates, Finland shipped 1,122,000 m³ as against the estimated 850,000 m³. On the other hand, Austria only exported 66,000 m³ as against the forecast of 180,000 m³, and Poland only 3,000 m³ against the forward estimate of 100,000 m³.

Total exports of pulpwood from European sources, and Canadian exports to Europe in 1951, showed a spectacular increase over earlier postwar years.

European exports of pitprops and pulpwood in 1949-1951 compared with the average exports of 1935-1938 by main regions of supply are shown in Table 7. This table shows how eastern European sources of supply have completely lost their predominant position of the

TABLE 6. — IMPORTS.

| Country | 1951 | | 1950 | | 1949 | | 1935-1938 | |
|---|---|---|---|---|---|---|---|---|
| | Pitprops | Pulpwood | Pitprops | Pulpwood | Pitprops | Pulpwood | Pitprops | Pulpwood |
| | (1000 m³) | | | | | | | |
| Austria | — | 157.6 | — | 87.4 | — | 185.0 | — | — |
| Belgium [1] | 371.5 | 184.3 | 199.3 | 218.6 | 281.1 | 54.0 | 629.0 | 212.0 |
| France | 140 2 | 522.8 | 300.0 | 161.0 | 958.0 | 693.0 | 168.0 | 668.0 |
| Germany (Fed. Rep.) | 57.6 | 1 253.1 | 112.4 | 638.4 | — | 238.0 | [2] 128.0 | [2] 4 201.0 |
| Italy | 9.8 | 434.0 | 6.5 | 355.2 | 1.4 | 272.0 | 4.0 | 213.0 |
| Netherlands | 104.6 | 469.8 | 60.8 | 251.4 | 202.7 | 228.0 | 254.0 | 358.0 |
| Norway | — | 648.3 | — | 216.7 | — | 63.0 | — | 182.0 |
| Spain | .. | .. | 30.0 | 25.0 | 12.0 | 26.0 | 14 0 | 7.0 |
| Sweden | 0.1 | 744.8 | 0.1 | 489.8 | — | 437.0 | 2.0 | 309.9 |
| Switzerland | — | 407.3 | — | 33.9 | — | 99.0 | — | 147.0 |
| Turkey | 133.6 | 5.5 | 132.1 | — | 142.5 | 28.0 | .. | .. |
| United Kingdom | 1 784.6 | 312.9 | 1 559.5 | 237.7 | 2 390.1 | 101.0 | 3 386 0 | 701.0 |
| Other countries | — | 2.75 | — | .. | — | 2.0 | — | — |
| TOTAL | 2 600.0 | 5 143.1 | 2 40 ).7 | 2 715.1 | 3 987.8 | 2 426.0 | 4 584.0 | 6 998.0 |
| Czechoslovakia [3] | — | 5.8 | — | 7.7 | — | 21.6 | 4.0 | 97.0 |
| Eastern Germany [3] | — | 13.0 | — | 5.2 | — | — | [2] .. | [2] .. |
| Hungary [3] | — | 31.9 | 23.8 | 0.8 | 102.2 | 37.8 | 163.0 | 403.0 |
| Poland [3] | 21.1 | — | — | 10.0 | 5.0 | — | — | — |
| U.S.S.R. [3] | — | 283.3 | — | 187.6 | — | 237.0 | — | 10.0 |
| TOTAL | 21 1 | 334.0 | 23 8 | 211.3 | 107.2 | 296.4 | 167.0 | 510 0 |
| TOTAL EUROPE | 2 623.1 | 5 477.1 | 2 424.5 | 2 926.4 | 4 095.0 | 2 722.4 | 4 751.0 | 7 508.0 |

[1] Including Luxembourg. [2] Germany of 1938. — [3] As reported by exporting countries, with the exception of the average of 1935-38.

TABLE 7. — EXPORTS.

| Country | 1951 | | 1950 | | 1949 | | 1935-1938 | |
|---|---|---|---|---|---|---|---|---|
| | Pitprops | Pulpwood | Pitprops | Pulpwood | Pitprops | Pulpwood | Pitprops | Pulpwood |
| | (1000 m³) | | | | | | | |
| Austria | 65.9 | — | 94.7 | 0.1 | 80.0 | — | 71.0 | 394.0 |
| Belgium [1] | 53.5 | 9.9 | 27.0 | 1.9 | 62.4 | 54.0 | 55.0 | — |
| Finland | 1 121.9 | 3 495.8 | 880.0 | 1 882.3 | 1 135.0 | 846.0 | 1 700.0 | 1 190.0 |
| France | 348.8 | 16.8 | 185.0 | 22.4 | 140.0 | * | 439.0 | * |
| Germany (Fed. Rep.) | 121.6 | 12.5 | 360.7 | 133.1 | [3] 746.0 | [3] 790.0 | [2] 24.0 | [2] 6.0 |
| Ireland | 14.8 | — | 12.2 | — | 7.3 | — | 7.0 | — |
| Norway | 64.8 | 9.4 | 50.1 | 1.8 | 101.0 | [3] 298.0 | 34.0 | 14.0 |
| Portugal | 145.0 | .. | 71.5 | 20.0 | 219.0 | 26.0 | 342.0 | * |
| Sweden | 317.0 | 169.1 | 241.8 | 255.3 | 660.8 | 129.0 | 194.0 | 126.0 |
| Yugoslavia | 22.5 | 395.8 | 113.6 | 446.3 | 189.3 | 477.0 | .. | .. |
| Other Countries | 2.5 | 0.5 | 0.5 | 13.5 | — | — | — | — |
| TOTAL | 2 278.3 | 4 109.8 | 2 037.1 | 2 776.7 | 3 340.8 | 2 620.0 | 2 866.0 | 1 730.0 |
| Czechoslovakia [3] | 8.3 | 20.7 | 16.5 | 18.8 | 10.5 | 30.6 | 73.0 | 716.0 |
| Eastern Germany [3] | 17.1 | — | — | 5.0 | 135.4 | — | — | — |
| Poland [3] | 2.6 | 157.1 | 216.0 | 102.2 | 68.6 | — | 162.0 | 432.0 |
| Romania [3] | — | 6.6 | — | — | — | 8.1 | — | 34.0 |
| U.S.S.R. [3] | 275.5 | 1.1 | 212.9 | 44.1 | 109.9 | — | 1 757.0 | 2 967.0 |
| Other Countries [3] | — | — | 2 8 | — | — | — | — | — |
| TOTAL | 303.5 | 185.5 | 448 2 | 170.1 | 324.4 | 38.7 | 1 992.0 | 4 149.0 |
| TOTAL EUROPE | 2 581.8 | 1 295.3 | 2 485.3 | 2 946.8 | 3 665.2 | 2 658.7 | 4 858.0 | 5 879.0 |
| Canada [4] | 219.4 | 763.1 | 62.1 | 92.7 | 709.7 | 76.7 | (300) | 274.0 |
| U.S.A. [3,4] | 42.8 | 3.5 | — | 0.2 | * | 3.9 | | |
| GRAND TOTAL | 2 844.0 | 5 061.9 | 2 547.4 | 3 039.7 | 4 374.9 | 2 739.3 | 5 158.0 | 6 153.0 |

[1] Including Luxembourg. [2] Germany of 1938. [3] As reported by importing countries. [4] To Europe only. * Secretariat estimates.

prewar period and how, consequently, western European countries have come to depend on supplies from within that region. The growing importance of Finland as a source of supply to western Europe is clear.

*Prices*

Prices of pitprops and pulpwood, which in 1948 and 1949 were higher than ever before, fell sharply in 1950. In the case of pulpwood this decline was particularly remarkable. Pulpwood prices, which had been around $13 to $14 per piled cubic meter f.o.b. for half-barked spruce pulpwood in 1948 and 1949, were as low as $6.25 to $7 during the first half of 1950. Prices of pitprops, which had not climbed so fast, changed only slightly when they adjusted themselves to the 1950 level of pulpwood prices. Thus, during the first half of 1950, prices of both pitprops and pulpwood were more or less the same, namely about 50 shillings per piled cu. m. f.o.b. ($6.25 to $7 per piled c. m. for pulpwood and 290 to 305 shillings per fathom for pitprops).

However, the rise of pulpwood prices which started toward the end of 1950 and continued throughout the following year was rapid; it was not until June 1951 that pitprop prices reached the same level. During the second half of 1951, pitprop prices again lagged behind. With the weakening in the demand for pulpwood toward the end of the year, pitprop prices once more caught up. By the end of 1951, prices of the two commodities were almost at the same level. (See Table 8).

TABLE 8. — THE DEVELOPMENT OF PITPROP AND PULPWOOD PRICES (1948-1952)

| | 1952 | 1951 | | | | 1950 | | 1948-49 |
|---|---|---|---|---|---|---|---|---|
| | Jan. | Nov. | Sept. | June | Mar. | Jan. | Feb. | Average |
| | (..... Shillings per piled cubic meter, f.o.b. .....) | | | | | | | |
| Half-barked spruce pulpwood | 121-128 | 140 | 130 | 114 | 105 | 75 | 50 | 105 |
| Pitprops | 122 | 132 | 118 | 114 | 67 | 64 | 44 50 | 44-50 |

This table gives a fairly accurate general picture of the price developments on the European market from 1948 to the beginning of 1952, although prices were not uniform everywhere. The increase in pitprop prices from September to November 1951 was caused by French purchases from Finland at 800 to 810 shillings per fathom f.o.b. instead of at the price of 700 to 750 shillings paid earlier by most of the importing countries.

Toward the end of 1951, prices again showed a tendency to fall but they now seem to remain firm.

*Outlook*

Despite the fairly satisfactory supply position at the end of 1951, there is reason to fear new difficulties later this year. Depending largely on developments on the pulp and paper market, the reduced demand for pulpwood during the early months of 1952 may later be followed by a purchasing campaign similar to that of 1951. Reductions of 20 to 30 percent in the prices of pulp may curtail production, particularly in the main exporting countries. But if there is only a slight reduction in prices, pulp production may not fall and pulpwood stocks at mills will need replenishing. In the past, most pulp producing countries have made large purchases of pulpwood simultaneously, and the same thing may happen again. A cautious prediction might forecast this demand for the autumn of 1952. This is the season when coal mines also traditionally make their purchases for the coming year, or at least plan them. This year European stocks of pitprops are rather low, and it is improbable that there will be any substantial increases in the immediate future. Thus, by autumn, competition between pitprops and pulpwood may once more occur in the European market. Prices may also be affected by the fact that some traditional suppliers of roundwood to the western European countries are gradually disappearing from the market. Yugoslavia, for example, is planning to discontinue all pitprop exports, which even in 1951 were only deliveries of earlier contracts. Yugoslav exports of pulpwood have also shown a steady drop and may be expected to decline further in 1952. This, in its turn, may limit Austrian exports of pitprops, since that country has, while exporting pitprops, drawn heavily on Yugoslavia for pulpwood. Italy has also depended strongly on supplies from the same source. Substitute supplies may have to be sought in other markets.

This situation makes it appear that the only country in Europe in a position this year to export large quantities of pitprops and pulpwood will be Finland. Pitprops and pulpwood are now, however, subject to export licences. Policy for some years has been to encourage exports of finished products, so it may be assumed that the Finnish Government will only tolerate exports if market conditions permit them to bring in sizeable amounts of foreign currency. In view of Finland's position as the only possible big supplier to the rest of Europe, spectacular price reductions seem most unlikely to occur this year.

Sweden may be accounted as an important exporter of pitprops only. France's exports cannot be expected to continue at the present level since it is becoming increasingly dependent on imported roundwood.

Supplies from the U.S.S.R. are still a matter of speculation. Exports of roundwood from North America depend largely on the dollars available in the European importing countries, and also to some extent on the demand by the United States for Canadian supplies. Thus any new boom in the world wood pulp market would reduce the availabilities in the Western Hemisphere of roundwood for Europe.

Prospective supplies from the eastern European countries are governed by somewhat different factors. The fact that supplies delivered by these countries to western Europe have been small has been only partly due to political factors. The eastern European countries are generally believed not to be in a position to export at prewar levels. The domestic woodworking industries are reported to have greatly expanded, while at the same time, it is believed, the productive capacity of the forests is less than prewar. These factors suggest that no large exports of roundwood from these sources will be forthcoming in the near future.

# *The Work of FAO*

## Increased Production of Pulp and Paper

The last session of the FAO Conference resolved to lend assistance to the United Nations in long-term efforts to overcome the shortage of newsprint and printing-paper in many parts of the world. Since that time the situation with regard to pulp and paper has eased considerably, but the basic fact remains that large areas of the world do not, and under present circumstances cannot, have adequate paper supplies. There is therefore an added argument in favor of a thorough examination of the long-term prospects for the production and consumption of these commodities.

FAO's broad action program is based on three assumptions: (*a*) that the fight against illiteracy and for freedom of information can be won only by a continuous and very substantial increase in the supply of newsprint and printing papers; (*b*) that expansion in production of newsprint and printing paper must go hand-in-hand with expansion in production of pulp and paper for all major uses; and (*c*) that the striking inequality between the pulp and paper consumption of 500 million people living in North America and Western Europe and of the rest of mankind will be difficult to overcome so long as pulp production remains concentrated in a few countries.

A program, however, can only be determined in the light of answers to the following questions:

1. At what rate can effective demand for pulp and paper in the various regions be expected to grow during the decade ahead?

2. To what extent will the expanded pulp and paper production of the traditional producing centers to meet the growing requirements of the deficient countries? This question must be answered with due regard to the foreign exchange facilities of these countries.

3. What is the present status of industrial techniques for the manufacture of pulp and paper from hardwoods, tropical woods, and other fibrous materials which constitute the bulk of raw materials available outside of Europe and North America? What processes should be employed? What products could be obtained and at what cost? Can the raw materials be supplied in adequate quantities under good forest management?

4. Where should new mills be located and what is the potential capacity for manufacturing pulp and paper, including newsprint, in each major region?

Any broad program undertaken before there are adequate replies to these questions could easily lead to unsound investment and serious failure. Governments and private corporations will, of course, go ahead without delay with a limited number of well-planned projects wherever conditions appear to be favorable, but a broad program of production should begin with a world-wide survey. Such a survey should have:

(1) a world survey of technical and economic possibilities for the expansion of pulp and paper production and the relationship to prospective needs for newsprint and other pulp products;

(2) drawing up specific plans for locating new mills, in a form suitable for consideration by financial institutions and private investors;

(3) negotiation and conclusion of the necessary financial and technical arrangements for the construction of new plants and to ensure the permanent supply of raw materials; and

(4) erection of new mills, including the initial phases of the operations which invariably meet with considerable difficulties, especially in countries which do not yet possess a pulp and paper industry and as a consequence do not have personnel familiar with these operations.

Wherever appropriate, FAO through its technical assistance program is ready to assist governments in all four phases. So far the efforts of the Organization have been concentrated on the first phase of the above program.

*Appraisal of future demand*

UNESCO has issued to its member countries a questionnaire, established in consultation with FAO, and is now collecting information about present and future requirements of newsprint and printing papers. A study on European timber trends, undertaken as a joint project by FAO and ECE, contains information on Europe's prospective requirements for pulp products up to 1960. Another study on Latin American pulp trends is under preparation as a joint project of FAO and ECLA.

*Expansion of capacity in the traditional producing areas*

An OEEC survey in its member countries, of investment programs in European pulp and paper industries is now supplemented by a more limited inquiry undertaken by the International Material Conference. Present and future pulpwood supplies and pulp production in Europe were discussed at the latest session of ECE's Timber Committee. Information has been obtained from government agencies and producers' associations in Canada, the United States, Norway, Sweden, Finland, Austria, Australia, New Zealand and a number of other industrialized countries to secure information about their known plans for increasing pulp and paper capacity.

*Technical progress in pulping methods*

FAO's Wood Chemistry Committee held a meeting last September in Appleton, Wisconsin, devoted to the pulping of tropical hardwoods and agricultural residues. Several well-known experts have been asked by FAO to co-operate with the organization in a technical meeting to be held toward the end of 1952. This will examine possible standard pulping tests for use in connection with the FAO project and to summarize present methods of manufacture of pulp and paper from raw materials available in the underdeveloped countries outside of Europe and North America.

*Local exploration of conditions for the establishment of pulp and paper industries*

Arrangements for the despatch of technical assistance missions for this purpose have been concluded with the following countries: Bolivia, Cambodia, Colombia, Costa Rica, Cuba, Ecuador, Greece, Haiti, India, Iraq, Nepal, Paraguay, Peru, Turkey, Venezuela, Yugoslavia.

The following seven countries where FAO forestry missions are already at work have requested pulp and paper experts: Brazil, Chile, Ethiopia, Indonesia, Mexico, Pakistan and Thailand.

Meanwhile authorities in the United Kingdom, France and Belgium are also studying the pulp and paper production possibilities in their dependent territories, especially in Africa.

From all the material obtained

from these various sources. FAO expects to assemble information which will indicate (*a*) how much pulp and paper capacity could be developed during the coming decade; (*b*) where, at what cost, and under what conditions such a development could take place; (*c*) how the prospective production appears to compare with prospective requirements of the various regions. In this way priorities could be established which would facilitate the selection of the most suitable countries and sites, after evaluation of raw material availabilities and production costs.

A report summarizing the results of all these investigations will be presented to the Economic and Social Council of the United Nations in 1953.

# FAO Forestry Mission for Chile

*The FAO Forestry Mission to Chile, whose work is described in these pages, has found considerable reserves of timber in the country. Among the important timber species is the Chile pine, better known to many as the "monkey puzzle"* (Araucaria araucaria), *a virgin forest of which is seen in this photograph.*

Perhaps the most important achievement of the FAO Forestry Mission to Chile in the first year of its assignment has been its contribution to revisions in forestry legislation. The Mission advised a committee set up by the Ministry of Lands and Colonization which has drafted a bill representing a real advance over existing legislation along the following lines:

> provisions for safeguarding remaining national forest areas from destruction or unwise disposal; regulations for the protection and rational management of forest lands, including those privately owned where the national interest so requires, as in water-shed areas; creation of a more adequate Forest Service; provision for forestry education and research.

The main forest problems of Chile, as determined by the Mission, are protection of natural forests, protection of the soil against erosion, need for management of forests for sustained yield and necessity for the better organization of timber production. The Mission is undertaking detailed studies and proposals for action on the above problems in limited areas. These will serve to demonstrate the utility of corrective or remedial measures.

An important result of the Mission's activities has been the decision of the Government of Chile to establish a Forestry Faculty in the University of Chile. FAO has agreed to furnish three instructors for the initial period of this school.

A Demonstration Forest, for research and training, is also to be established, which will be a summer teaching area for the forestry students. It will also serve as a demonstration area for industrial operators interested in more modern methods. Modern methods of mechanical ex-

traction and an up-to-date sawmill for the processing of the timber derived from the area under a sustained-yield working plan, will be included. FAO is providing equipment not readily procurable in the country, and Chilean authorities are providing the necessary buildings and operating staff and assuming full maintenance responsibility.

Soil conservation, particularly in the northern arid region and in coastal areas affected by shifting sand dunes, presents a very important problem in Chile. FAO's Forestry and Agricultural Missions are working together to determine the extent of the erosion problem. A plan for control in an important sand dune area has already been presented.

As regards the organization of timber production, there already exists a definite pattern of forest economy in Chile. The Mission is not attempting to alter radicall structure of this economy but troduce such improvements as possible in existing methods of f ing, logging and conversion. A ge eral study is being made of present methods of exploitation and of exist ing forest industries in Valvidia province, in co-operation with the Corporación de Fomento, with a view to developing an integrated forest industry in the Province.

# Subcommission on Mediterranean Problems

This subsidiary body of FAO's European Commission on Forestry and Forest Products was created in 1948 to deal with specific forestry problems of the Mediterranean region and to investigate the problems of other areas having a similar "Mediterranean" climate. A third meeting of this Subcommission was held at Istanbul, Turkey, 13-15 May, under the chairmanship of Professor Pavari (Italy), with Professor Gonzalez-Vazquez (Spain) as vice-chairman. The meeting was preceded by a field trip arranged by the Director-General of Forests, Turkey, and the members of the Faculty of Forestry at the University of Istanbul.

Besides representatives from the host country, delegates attended from Spain, France and the French Union, Greece, Israel, Italy, Portugal, United Kingdom, and Yugoslavia. After the Minister of Agriculture had welcomed the delegates and described the steps being taken in Turkey for the conservation and protection of the country's forests, Mr. Leloup, Director of FAO's Forestry Division, spoke of the many common problems facing countries of southern Europe and of the Middle East and North Africa. He thought that it might eventually prove possible to transform the Subcommission into an international Commission serving the interests of all the regions concerned. He particularly drew attention to the value of eucalypts as a means of solving some of the regional problems and mentioned the monograph on the genus which was being prepared by FAO, and the tour to Australia due to take place later in the year when eucalypts could be studied in their native environments. Metro, who is writing the eucalypt monograph for FAO, then expanded further on the possible role that various species and varieties could play.

The Subcommission expressed the hope that small national units could be established to review the experience with eucalypts, and to report on the results obtained with the various species, their adaptation to different environments, their biology, silvicultural treatment, growth, and utilization possibilities. The International Union of Forest Research Organizations was asked to undertake provenance tests with seed from acclimatized species and to study the genetics of eucalypts, and also the effect of various species on soil conditions.

*Grazing and forestry*

The secretary, Fontaine, gave the delegates a broad outline of the study on *Grazing and Forestry* which had been completed by FAO and was due shortly to be published, and the whole subject of the relation between these two often competing modes of land use was discussed.

Considering the extreme importance attaching to grazing within forest boundaries in many countries of the region, the Subcommission called for systematic efforts towards improvement of natural pastures and grasslands, and also a search for better breeds of animals which would give higher yields for a smaller head of stock. A wholly negative policy of forest closure and exclusion of grazing often defeated its own ends by the opposition aroused, leading to the malicious burning of forests. All the administrative government agencies must combine to find solutions suited to local conditions, and when requested, FAO should by technical advice and distributing the results of experience in member countries, offer guidance in this crucial matter.

*Utilization of forest produce*

Considerable discussion was devoted to the question of so-called "minor forest products" from the forests of the Mediterranean region. The report of the permanent working party on cork was approved and preparations for its next meeting were agreed.

FAO was asked to consider publishing a bulletin which, drawing on reports from member governments, would deal with production and trade in resins, acorns and other fruit such as edible chestnuts, barks, gums, leaves, and tanning materials.

*Other activities*

The Subcommission examined the ecological map of the Mediterranean area prepared in accordance with the accepted program of work, and agreed on certain modifications and improvements to be made. Note was taken of the detailed vegetation and ecological mapping now being undertaken in Portugal.

# New Chief of U. S. Forest Service

The appointment of Richard E. McArdle as Chief of the Forest Service, U. S. Department of Agriculture has been announced. He succeeds Lyle F. Watts, who retires from active duty 30 June.

Prior to his appointment as Chief Forester, Mr. Watts' forestry career included service in four of the ten national forest regions, two of which he headed as U. S. regional forester. He also spent several years in research and was the organizer and first head of the School of Forestry at Utah State Agricultural College.

Mr. Watts was chairman of FAO's Standing Advisory Committee on forestry, and took an active part in the organization and development of the forestry division of FAO. He was technical adviser to the U. S. delegate to general sessions of FAO in Quebec 1945, Copenhagen 1946, Washington, D.C. 1948 and 1949, and Rome 1951. He was also a U. S. delegate of the Inter-American Conference on the Conservation of Renewable Natural Resources at Denver in 1948, and the United Nations Scientific Conference on the Conservation and Utilization of Resources at Lake Success in 1949.

Mr. McArdle has since 1944 been Assistant Chief in charge of State and private forestry co-operation.

# *Equipment News*

*Interest in the development of forest utilisation and woodworking industries is reflected in the continual demand for information on new equipment. FAO's Forestry Division collects such information and passes it, on request, to Member Governments. Some of the information collected is published here. FAO accepts no responsibility for the claims put forward by manufacturers.*

LATIL TRACTOR TYPE TL. — A four wheel drive tractor with two series of speeds, for hauling and forest extraction work.

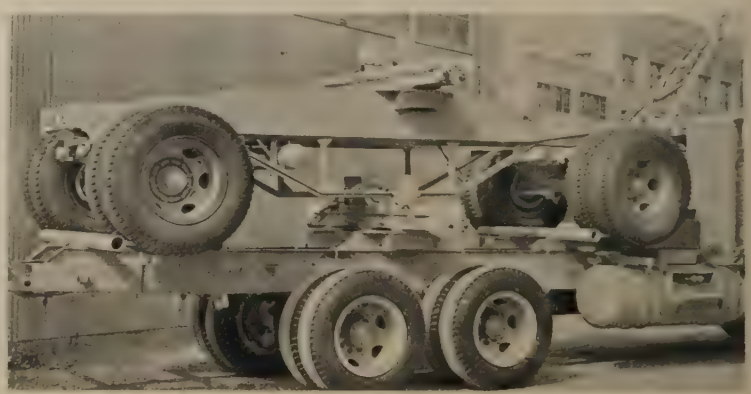
*Specification*: The tractor carries at the back a winch with traction power up to 5,000 kg. and automatic and retractable sprag anchor. Weight of tractor, approximately 4 tons. It is equipped with heavy tires suitable for all types of terrain. Tractor can climb gradients of up to 30 percent. Heavy oil motor, 65-85 h.p., direct injection.

*S. A. LATIL, 8 Quai Galliéni, Suresnes (Seine), France.*

RELIANCE "DUAL PURPOSE" TRAILER. — A trailer for use with standard type truck equipment. It can be loaded on the truck for return trips if the truck frame is 20 ft. or longer, as seen in this illustration.

*Specification*: two-axle trailer with frame of high tensile steel; steering through ball-bearing fifth wheel; drawbar is compensating (or sliding) similar to the reach or pole on logging dolly; bunks are mounted on fish-plated sub-frame, which in turn is bolted to regular frame — both bunk and sub-frame are easily removed.

Length of frame, 20 ft.; depth, 9 in.; capacity of axles, 18,000 lb.; brakes (Westinghouse) 16 × 7 in. with 3/4 in. lining; weight of trailer 7,600 lb. (approx.) with log bunk equipment on 10 × 22 tires. Axle loading: truck steering axle, 8,500 lb.; truck driving, 32,000 lb.; trailer front axle, 18,000 lb.; trailer rear axle, 18,000 lb.; total axle load, 76,500 lb.

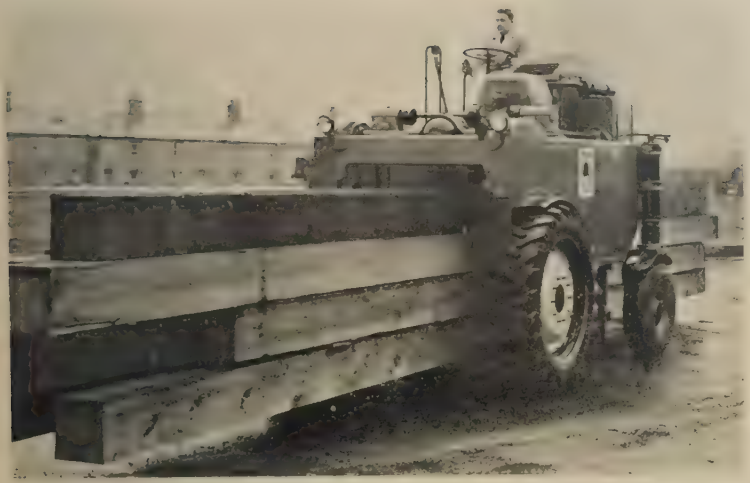


*Reliance Trailer & Truck Co. Inc., 2765 Sixteenth Street, San Francisco 3, California, U.S.A.*

SLIDE FOR HAULING PULPWOOD. — Removing pulpwood to central collecting dumps for loading can be a tedious operation. This slide permits easy hauling and can be loaded intact onto the carrier.

*Specification*: all sections of the slide are welded together, with runners made by splitting into two a 10 or 12-inch iron water pipe. With the exception of the standards it is constructed of 6-inch angle I-beams. "Platform" on which pulpwood is placed is raised 16 inches above the ground to allow slide to run over a stump without hindrance. Uprights or standards are of thick, strong, drill stem pipe to prevent risk of bending. They are hollow, so that billets can be inserted in the tops and the height of load increased considerably. Average load: two standard cords of 5 ft. bolts.

*U. S. Forest Service, Southern Forest Experiment Station, Crossett, Arkansas, U.S.A.*



P. C. L. "Timber Wo[illegible] machine is the first stra[illegible] to be in production in E[illegible] has deep section side [illegible] main framework of [illegible] quality steel plate; open co[illegible] of frame gives maximum visi[illegible] of load hooks.

*Specification*: load hooks are 6 × 6 in. steel angles, 7 ft. 6 in. long attached at either end to vertical steel tubes. Power unit: Perkins P. 61. 6 cylinder 4 stroke industrial diesel engine; heavy duty gear box with six speeds - 3 forward and 3 reverse with single lever remote control selection. Steering: at maximum lock inside turning radius is 9 ft. Lifting control unit: comprises combined clutch, reversing gear and clamping brake and is controlled by the driver with a single lever.

*Pest Control Ltd., Bourn, Cambridge, England.*

Staffa 2/3 Ton Mobile Crane. — Completely mechanical crane specially constructed to reduce maintenance to a minimum, and to ensure that where maintenance is inevitable it will be of a simple mechanical nature.

*Specification*: Hydraulic ram for raising and lowering the jib, the hoisting mechanism comprising a fan-cooled worm reduction gear upon which is mounted the grooved drum conveying 65 ft. of $^{5}/_{8}$ in. diameter wire rope. Crane is powered by a Newage/Austin industrial petrol engine developing 15 b.h.p. at 1,800 r.p.m.; four speeds forward and one reverse. Twin front wheels and rear steering wheels are fitted with 26×6 pneumatic tires. Chassis is fitted with a front bumper plate to give maximum protection to tires and wheels and also to push loads or vehicles if required.

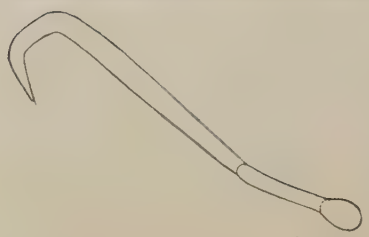
*Chamberlain Industries Ltd., Staffa Works, Leyton, London, E. 10, England.*

Hayter rotary grass cutter. — A machine for cutting grass and weeds on parklands and open plantations. Because of its low overall height of 18 in. and offset, it can cut right up to the tree trunks without risk of damage. Cutting width of single machine is over 6 ft. and cutting height is adjustable up to 6 in. A special coupling is available enabling two machines to be worked together, giving a cutting width of about 13 ft. Each machine has independent vertical movement so as to work efficiently on rough ground. A flexible wing is also available which can be quickly attached to either side of a single machine, giving an additional cutting width of about 2 ft.

*Hayters Limited, Spellbrook, Bishop's Stortford, Herts., England*

Several firms build boats specially suited to the conditions under which they are expected to operate. There is no rigid model pattern. Illustrated are a 28 ft. boat designed for towing logs downstream under turbulent water conditions, and a 15 ft. boom boat for moving logs within a storage basin.

*John Manly Ltd., Commercial Steel Boat Building, P. O. Box 591, New Westminster B. C., Canada.*



RIPPER TYPE PULPHOOK. — A very light ripping stroke is used to sink the hook into the block, usually catching just over the top of the stick from the worker, thus giving it a better chance to hook. Due to the light blow needed, there is practically no danger of it missing and causing injury to the operator's knee or leg, thus considerably reducing pulphook accidents. Any regular type pulphook can be converted into a ripper by a blacksmith using this sketch as a pattern.

*Specifications*: Overall length 13 in.; width of blade at widest point 3/4 in.

*Canadian Pulp and Paper Association, Woodlands Section, 2280 Sun Life Building, Montreal 2, Canada.*

LIGHTWEIGHT SCALING LADDER. — "Duralumin" ladder designed at the Forestry School, Nancy, to allow seed collection and tree pruning without causing injury to the tree trunk.

*Specification*: composed of aluminum sections 3 meters long fitting into one another and attached firmly to the tree by chains which are fixed while ascending. Elasticity of the metal allows the ladder to follow the irregularities of the tree trunk while remaining safely rigid. Operator is secured, depending on tree trunk dimensions, either by a cord round the trunk or a chain from his belt to the upper rungs while the next section is put in place. Weight of 3-meter section - 4.6 kg.; maximum vertical load in center of rung - 150 kg.

*BEGA Constructors, 54 Avenue du XX^e Corps, Nancy, France.*

ONE-HALF TO ONE TON SLIP-ON TANKER AND TRAILER UNIT. — A pilot model mounted on a jeep which can be used either as a 3-unit equipment box or, by mounting a pump and reel frame on top, can be made into a slip-on tanker.

*Specification*: The box or tank consists of 3 water-tight compartments with hinged lids and baffle plates. Two tank heights are available, 17 1/2 in. and 21 in. with capacities of 160 and 200 gallons respectively. When either of the side compartments are not used for water, they can become tool or equipment boxes. All three compartments are connected by removable plugs and are treated for rust prevention. Overall width, 47 in. on each side; tanker can be mounted in four different positions on a 1/2 ton truck bed. Pump is a positive displacement gear type, rated at 18 gallons per minute at a pressure of 250 lb. per sq. in. Engine is air cooled, four stroke, 6 h.p. at 2,700 r.p.m. Total weight of engine and pump unit, 96 lb.; reel capacity, 200 ft. of 1 in. cotton jacketed, rubber lined, or 3/4 in. high pressure rubber hose.

The trailer is intended for off-road use, being designed for towing by truck or by tractor. It is low-built so as to act as a sled in crossing rough ground.

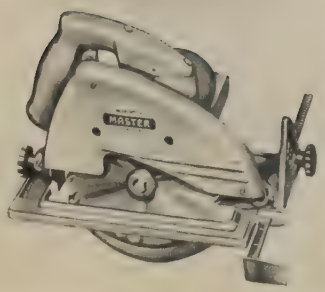
*Specification*: Load capacity, 2 tons; capacity of trailer tank, 300 U. S. gallons. The pump is four stage centrifugal with an output of 20 gallons per minute at 400 lb. per sq. in. or 90 gallons per minute at 100 lb. per sq. in. The slip-on tanker is one of the many units constructed for use with the trailer. Larger water tanks without pumps, lubrication units for servicing tractors on the fire line and tanks with different pumps have also been designed to fit the trailer.

*U. S. Forest Service, Arcadia Equipment Development Center, Arcadia, California, U.S.A.*

HEDDEN METAL DETECTOR, MODEL DC-II. — Metal embedded in logs is the sawmiller's nightmare. This instrument carried the length of a log indicates the presence of metal on a meter under a sensitivity line on the detecting head. Battery life approximately 200 hours; all parts, including batteries, are standard radio equipment.

*Specification*: Weight, including batteries, 11 lb.; length, 30 in.; overall height, 8 1/2 in.; width of detachable detecting-head, 13 in. Rugged plywood construction.

*Hedden Metal Detectors, 2329 Liberty Avenue, Pittsburgh 1, Pennsylvania, U.S.A.*




MASTER ELECTRIC PORTABLE 6 1/4 in. CIRCULAR SAW. — This saw is equipped with a 6 1/4 in. blade which allows for cutting through 2 in. stock at 45° angle. The 3/4 h.p. motor, with lightweigth aluminum housing is situated at the left of the blade for perfect balance and easier cutting. The saw has built-in bevel and depth adjustment, easily adjusted and remaining accurate. A plastic window in the guard allows operator to see the line of cut at all times in safety. Adjustable rip fence extends to 8 in. for precision ripping. Safety trigger switch in the handle cuts off motor when the operator's finger is removed from the switch. Lower safety guard covers the blade at all times and cannot become clogged with sawdust. The "Master" has large, self-lubricating, heat-treated, alloy steel motor shaft and drive gears.

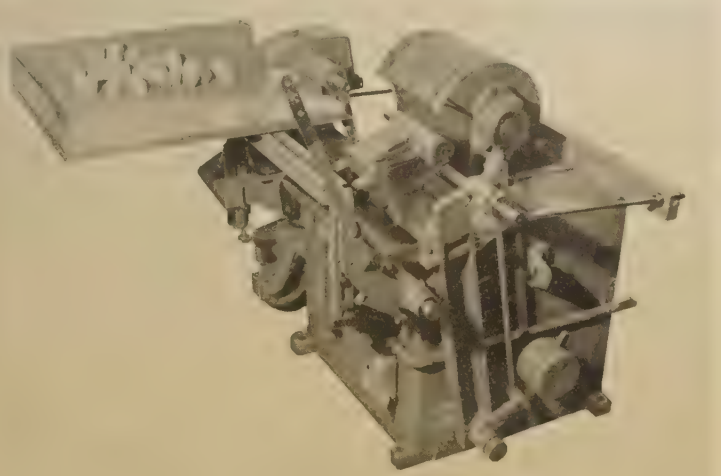
*Master-Taper Co., 4531 N. Beacon Street, Chicago 40, Illinois, U.S.A.*

VIRVOLT INDUSTRIAL TRUCK. — The truck has a combined steering and control wheel with a motor that turns on a control turret around its axis. Rotation on the spot enables the operator to change direction at will. Three models are manufactured: *V 35*, work load 2,205 lb.; 1 speed, 2 to 3 1/2 m.p.h.; 2 speeds, 3 1/2 to 7 m.p.h.: *V 80*, work load 4,410 lb.; 1 speed, 2 to 3 1/2 m.p.h.; 2 speeds, 3 1/2 to 7 m.p.h.: *V 150*, work load 6,615 lb.; speed, 3 3/4 to 10 1/2 m.p.h. Each model can be supplied with a tipping hopper, drop-side hopper, elevated hopper, platform with movable angle bracket, rising platform, wagon with fixed or large platform.

*Virvolt, 15 rue Galvani, Paris.*

TYSON PATENT SELF-LOADING AND EJECTING WOOD TURNING LATHE. — Base is of cast iron heavily ribbed to resist vibration. Steel Carriage supporting the work head and tailstock gives lighter and more easily operated trunnion than usual cast iron slide. Trunnion has independent 3-speed motor. Cutter headstock is rigidly fixed to the base casting; spindle, mounted in special ball bearings, runs at 7,000 r.p.m. With this high speed it is possible to use small solid steel cutter heads. The cutter and spindle may be detached quickly as a complete unit, and thus a quick change-over to a new operation is achieved by having pre-set cutter heads ready for the following batch of components. A 5 h.p. motor drives the cutter spindle through Vee ropes, adjustment being provided for tightening the ropes. Large work tray gives ample space for blocks and is convenient for loading the machine.

Operation is simple: a rough block is placed against a positioning device on the work tray and carriage moved towards the cutterhead (working stroke) against a pre-set stop which gives the correct diameter; carriage is then drawn back (return stroke). Principal feature of the machine is that the tailstock spindle is instantaneous self-loading and ejecting; mid-way on return stroke spindle retracts and ejects finished component into a chute and at the end of the stroke spindle snaps on to new block and is thus automatically reloaded. Work-head spindle always stops dead at same position so that flat articles may be picked up, and does not start revolving again until the wood block is away from the loading tray. Machine can produce a handle 3/4 in. diameter 7 1/2 in. long at rate of 30 per minute. Capacity of machine is 4 in. diameter, 12 in. length but machines to handle longer material are made to order. An ovalling attachment is available as an extra for hammer shafts.



*British Industrial Designers, Cavendish Chambers, Keighley, Yorks, England.*

# News of the World

*The items appearing here are condensed selections of news thought to be of interest to readers of* UNASYLVA. *They are grouped alphabetically by countries under headings currently used by the Forestry Division for reference purposes. The Editor will be glad to receive direct from readers authenticated items of interest and of news value for this part of the review.*

## General

### ARGENTINA

● The National Administration of Forests has established forest stations throughout the country as part of the Government's scientific, economic and social scheme. Of particular importance is the Mendoza forest station, situated in the Department of Rivadia, which was set up for the purpose of carrying out the following important research projects: (1) study of germination in indigenous and exotic species; (2) registration of plantations for the purpose of ecological research and for the study of the growth characteristics of indigenous species; (3) phenological studies; (4) the adaptation and acclimatization of species having properties which make them valuable lumber; (5) basic soil research for the practical application of new methods of growing indigenous species with reference to the climatic and physical conditions of the region; (6) the installation, already under way, of equipment for the impregnation of softwood and for the preservation of poles, vine props and stakes necessary for agricultural development in the Mendoza region. This equipment will be adaptable for use by individuals wishing to treat wood on a small scale.

### INDIA

● In an effort to remedy the acute food shortage, the Government of India, through the Ministry of Agriculture, has issued a booklet dealing with 50 forest sources of supplementary food, including species of fungi and vines as well as trees. The edible parts of the plant and their food value are described for each species.

### ISRAEL

● A forest dedicated to the memory of the late Count Folke Bernadotte has been inaugurated in Israel at Neve Ilan, near Jerusalem. The first trees were planted on January 28 by G. Hedengren, Swedish Chargé d'Affaires in Israel; General William E. Riley, Chief of Staff of the United Nations Truce Supervision Organization in Palestine; Moshe Sharett, Israeli Foreign Minister; and General Yival Yadin, Israeli Chief of Staff. A scroll was handed to Foreign Ministry officials for transmission to Countess Bernadotte. Cabled messages were read from United Nations Secretary-General Trygve Lie and from Dr. Ralphe Bunche, Count Bernadotte's successor as mediator.

Count Bernadotte's efforts to establish a truce were recalled in a tribute by General Riley, who said that not only was bitter fighting thus interrupted in Palestine, but the United Nations itself was immensely strengthened as a peace-making force. "In the Security Council truce order, in the formation and operation of truce supervision machinery, including a large corps of United Nations military observers, new and vitally important precedents have been established which have since had significance for beyond this area of the world," he declared. "This forest will pay an enduring tribute to an outstanding peace-maker, a great internationalist and humanitarian and a devoted servant of the United Nations. As it grows, may it ever flourish in that atmosphere of peace and goodwill among men for which Count Bernadotte gave his all."

### JAPAN

● *Forestry in Japan, 1945-1951*, Report No. 153 issued by General Headquarters, Supreme Commander for the Allied Powers, Natural Resources Section, describes the achievement of some 48 American and 3 Australian foresters working in cooperation with Japanese during the 6 years of military occupation. They analyzed the forest situation, delineating the most critical problems and developing remedial programs. It is a record of which the foresters of SCAP's Natural Resources Section can well be proud, for they have not only taken a new look at the forest situation in Japan, but also helped to formulate policies and legislation and assisted in carrying out basic recommendations aimed at promoting maximum sustained yield and efficient utilization of the country's forest resources.

The first 30 pages are devoted to a factual presentation of the forest situation; the organization and operational methods of SCAP, and of the Japanese Government and industry; and the distribution, ownership, and administration of forests and forest lands. The next 50 pages are given over to descriptions of the forest programs carried out under the occupation, and to the recommendations of the 10 visiting consultants on such subjects as a resources survey and statistics, methods of exploitation and utilization, management methods for timber, watershed and range purposes, reforestation, protection, taxation, extension services, timber owner's associations, timber export embargoes, legislation, and research. Maps, photographs, and tables in the text are used effectively to illustrate the general picture.

For reference purposes, the 60 pages of appendices provide tabulations of pertinent statistics, charts of organization, lists of personnel, lists of publications on which the report is based, and excerpts from the reports of visiting expert consultants.

This report is the most complete presentation now available of forestry conditions in Japan. It can be obtained from the office of Technical Services, United States Department of Commerce, Washington 25, D. C., or from GHQ, SCAP Diplomatic Section, Tokyo, Japan.

### UNITED STATES OF AMERICA

● The 51st Annual Meeting of the Society of American Foresters, held in Biloxi, Mississippi, December 12-15, 1951, reflected the wide range of interests of its members. In addition to 2 general technical sessions when 10 papers, largely dealing with various aspects of southern forestry, were presented, 13 separate division meetings were held at which a total of 66 papers were read. An additional general session was held dealing with business of the Society, and field trips to nearby places of interest occupied 1 full day and 2 half days.

This the Society continues to recognize the specialized interests of many of its members and to provide within its structure for their technical contributions to be received at annual meetings. Moreover, the annual meeting is held in a different forest region almost every year, and the emphasis of the agenda is always on contributions from foresters within the region and dealing with its particular problems.

● The State College of Forestry at Syracuse, New York, has published an annotated bibliography of aerial photography and its applications to forestry. There are more than 300 titles, divided into chapters on aerial photography, mensuration, surveying, interpretation, equipment and techniques, films and filters, fire protection, recreation, wildlife management, range survey and flood control.

CHILE

● The "yaretales" are the last shrub association at the highest elevations of the Cordillera de los Andes and in the corresponding zones in southernmost Chile. They lie within the elevated belt of the Andes where the prevailing climate is arid and where a fall in temperature causes intermittent violent storms in the summer. These storms, which mitigate the effects of drought in the hottest season, enable the vegetation peculiar to these extreme altitudes to survive.

The name "yareta" or "llareta" commonly refers to two genera of *Umbelliferae* typical of the Cordillera and the south antarctic region: *Laretia*, indigenous in Chile, limited in range to the elevated region of the Andes; and *Azorella*, which spreads also to the plains in the southern region.

The typical species *Laretia compacta* Reiche is frequently associated with "Yaretilla" (*Picnophyllum molle*, family *Caryophyllaceae*), as well as with flowering plants of the "tola"[1] such as *Baccharis rupicola*, and *B. genistelloides* (*Compositae*); *Fabiana* sp., (*Solanaceae*) and the "pajonales" *Stipa frigida*, *S. Chrysophylla* (*Gramineae*), etc, and, at about 4,000 meters, with the sole tree species of the region, "Quenoa" (*Polylepsis incana*, *Rosaceae*). Naturally the frequency of these plants depends on the elevation, exposure, soil, etc.; the most common species is *Stipa* ("paja") which extends to the furthermost limit for vegetation at high altitudes.

"Yareta" are perennial low-growing shrubs; the stem, branches and sometimes (*Laretia acaulis*) even the petioles up to insertion of the leaf blades, are all completely lignified. The leaves have a leathery texture and are closely inter-joined to form the typical convex impenetrable involucre. The common characteristic is the "cushion" shape of the epigeous part of the individual bushes, due to the apical position of the inflorescence which stimulates lateral secondary branching. In a typical specimen the cushion is so compact that it can scarcely be perforated by a bullet (Reiche). This exceptional resistance is due to the crowded development of the small branches, the interstices of which are filled with the undecomposed residue of the dead parts. The cushions are firmly fixed in the soil by very long tap roots and also by adventitious roots sent out by the lateral branches which intermingle with the tap roots. Even when several cushions grow close together, so as to form apparently one single bush, the individual plants can be easily distinguished by the flowers which develop in the center, slightly above the convex surface of the involucre.

In both the *Laretia* and the *Azorella* species, when the old part dies off in the center, the plant continues to grow. The new branches form a kind of ring around the dead part; this ring is not always complete.

Yareta, in the natural state or charred, are used for fuel. The plant is cut when the individual branches of the bush have become completely lignified and practically welded together to form a kind of conglomerate. It is supposed to take 40 to 70 years, depending on soil conditions and elevation, to reach this stage, but these figures have not been verified. Yareta burns slowly, without flame, and is a poor fuel which is only used for want of better.

Light and medium oils, tar for caulking, anti-corrosive varnishes can be extracted from yareta by distillation, but not on an industrial scale. A juice extracted from the root has a sedative effect in "puna" (mountain sickness) and is used as an anti-asthmatic.

The yareta trade is very nearly a monopoly. The cutting and cleaning operations are done by native inhabitants (foreigners would suffer from mountain sickness) who derive a small income from this activity. The native communities (Aymara Indians or Aymara mixed races) apply traditional methods of collective work in cutting the yaretales, which closely resemble the system obtaining in some communities in the Alps.

Yareta plants are not edible, but during the summer sporadic rains, an herbaceous vegetation springs up rapidly under their shelter or in the interspaces and serves as pasture for sheep and domesticated llamas and also for the wild vicunas which are fairly common in these parts. In addition, some pluriennal grasses like the "paja" (*Stipa* spp.: needle-grass) often occur with yareta and supply a moderate amount of forage for the animals of these regions. The tender non-woody parts, and the young shoots that sprout in the brief growing period, are good forage. For these reasons, yaretales, notwithstanding their intrinsic meagre value, are of indirect importance. Any appreciable reduction in the utilization of yaretales would severely hit the budget of many native families.

However, if yareta continues to be exploited at the current rate, the species confined to Chile will disappear, as has already happened in the zone bordering the railroad to Bolivia.

Legislative measures do not help the situation, partly because the enforcement of the law in these distant and elevated regions is very problematical (also because of the lack of technical personnel on the spot), and partly because the police measures are the only official measures taken and do not reach the root of the problem.

There are many technical points on which data are lacking (economic and physical maturity, methods of reproduction, association ch[illegible] etc.). Since the survival of [illegible] tales is extremely precari[illegible] their capacity for recovery [illegible] it appears that they should be trea[illegible] in the same way as shelter belts that is by purely conservation criteria.

[1] Tola zone: "tola" = *Baccharis* sp.

KENYA

● Dr. Charles R. Hursh of the Southeastern Forest Experiment Station, Asheville, North Carolina, U.S.A., is to study the effects of forests and forest removal on local climate and water resources in East Africa. He will work under a Fulbright Fellowship in association with the East African Agricultural and Forestry Research Organization, whose headquarters are in Kenya. The questions which he will study are of great importance in East Africa, as there are at present great differences of opinion among scientists as to the practical effect of forests on local climate and water resources. However, various associations of farmers are pressing the Government for strong policies of forest conservation and planting.

UNITED STATES OF AMERICA

● In order to shorten the production period of new pine hybrids, both male and female flowers must be available as early in the life of the tree as possible. In its genetics work, the California Forest and Range Experiment Station has recently investigated methods of inducing the formation of male flowers. The method used was to graft seedlings by inarching to a mature ponderosa pine which was prolific in its production of pollen and conelets, this being possible because it was known that intergrafting between hard and white pines can be done readily. The shock of grafting was considerable. During the first summer the grafted seedlings just held their own, by the following summer growth had started and the wounds healed and calloused. Flowering began about two years after the grafting in the following species: *P. torreyana* Parry (Torrey pine); *P. contorta* var. *latifolia* Engelm. (lodgepole pine); *P. sabiniana* Dougl. (Digger pine); Hybrid between *P. jeffreyi* Grev. and Balf., and *P. coulteri* D. Don. Slash pine (*P. caribaea* Morelet) failed to produce pollen.

As none of the grafted seedlings produced female flowers, research is now being conducted in this field.

● Since controlled water yield is the prime objective of wildland management in many areas of the hills and mountains of California, knowledge of the disposal of rainfall is a prerequisite for any plan of land management. The processes of rainfall disposal are well known in general terms: interception by vegetation, surface runoff, infiltration, evapotranspiration, percolation through the soil, spring and stream flow, storage in reservoirs, and evaporation from

water surfaces. But there is little detailed information regarding quantities and rates involved in each process.

The California Forest and Range Experiment Station has recently concluded a study of these factors on two important watersheds, by means of sample plots. One area is in the south-central Sierra Nevada Mountains, including woodland chaparral and ponderosa pine types. The other is in the Southern California chaparral with several brush types. The study involved, first, determination of water losses and water yield under natural vegetation and the effect of annual burning and denudation on losses and yield; and, second, calculation of water losses and yield from a single watershed. Experimental and analytical procedures were worked out, taking account of earlier work done in this field. While quantitative results apply specifically to the general types within which the studies were conducted, they may have indicative value in other areas with similar vegetation and soil types and with a Mediterranean climate. Moreover, it is probable that the methods employed will be applicable in similar studies conducted elsewhere on the management of wildlands for controlled water yield.

The principal conclusions reached were:

1. On plots with natural vegetation, average annual loss of rainfall due to interception ranged from 5 percent in woodland chaparral to 12 percent in ponderosa pine with an almost constant annual percentage.

2. The quantity of water entering the soil varied directly with annual rainfall, but evaporatory and transpiratory losses from each plot were uniform from year to year, average annual loss ranging from 14 inches (36 cm.) in woodland chaparral to 19 inches (48 cm.) in chamise brush.

3. Most of the annual evapotranspiration loss took place during the spring and summer dry season, varying from 56 percent of total annual loss in woodland chaparral to 76 percent in ponderosa pine. This loss was more strongly influenced by available water storage capacity of the soil than by any other factor.

4. Percolation varied from plot to plot according to soil variations, and from year to year according to differences in the amount and distribution of rainfall.

5. To raise soil water storage to field capacity, early season rainfall was required in amounts varying from 10 inches (25 cm.) in the woodland chaparral to 19 inches (48 cm.) in chamise brush.

6. The bulk of percolation took place between December and April, beginning when soil water storage was restored to field capacity, continuing during subsequent storms, and ending when rains became too frequent or too small to replace current evapo-transpiration losses.

7. Annual burning of woodland chaparral reduced the reception loss, thus increasing the amount of rain reaching the soil, and reduced the infiltration capacity of the soil, thus greatly increasing surface runoff. The result was that more rain was required each year to start percolation and the quantity of percolation was greatly reduced. Annual evapotranspiration was not appreciably changed by burning. The increase in total yield of the burned plot compared with the natural cover plot was obtained at the expense of greatly increased storm flows of runoff heavily charged with sediments. Similar results were obtained by annual burning of ground cover under ponderosa pine.

8. Removal of vegetation, trenching and maintenance of bare surface eliminated interception and transpiration losses, reduced evaporative but greatly increased surface runoff and erosion. Drying of the soil layer was less than on natural cover or annually burned plots, and thus deep-soiled bare plots entered each rainy season with a greater carryover than those with shallow soils. Total water yield was greatest from bare plots, out percolation yield much less than from natural plots.

9. On the 875-acre (354 ha.) watershed studied as a whole with an average annual rainfall of 31 inches (787 mm.), the disposition was 2 1/2 inches (64 mm.), interception loss, evapo-transpiration and riparian losses 10.8 inches (274 mm.), percolation 17.8 (451 mm.) of which only 4 inches (10.2 mm.) left the watershed as measured stream flow, thus leaving 13.8 inches (350 mm.) as underground flow.

## Silviculture

CANADA

In 1945 joint concern of Government and industry as to what was happening to cut-over and burned-over forest led the Woodland Section of the Canadian Pulp and Paper Association to propose a systematic survey. This was done by the Research Division of the Association's Forestry Branch from 1946 to 1948. The primary purpose was to find the extent to which such forest was reproducing in various sections, particularly to coniferous pulpwood species; the secondary purpose was to develop a satisfactory inventory system and to determine the more important limiting factors where reproduction was unsatisfactory. This survey constituted the first stage in a co-ordinated study of the problem. The second stage involves study of the factors causing success or failure of regeneration and the third stage involves devising measures to correct existing conditions and thus to ensure success in obtaining reproduction. Studies on the first two stages are underway.

The report of the first stage of the research shows that 583,000 quadrats (each 2 × 2 m.) were observed, arranged in plots of 20, with 100 plots in each selected area. The latter were chosen to sample (1) the forest section - the boreal, sub-alpine, montane, coast, Columbia, deciduous, Great Lakes-St. Lawrence and Acadian forest regions; the interior plains and sagebrush-grass grassland formations; the tundra formation; (2) the original forest type; (3) the nature of the disturbance; (4) the age group since disturbance. Results are reported and analyzed separately for each province.

Areas studied, which had been mature and overmature, had been logged very severely only once. The survey methods used initially and subsequent modifications will interest technicians in this highly specialized field. Of wider concern, however, are the major findings of fact, and particularly interpretations of the facts for, as the author of the report says, "while the results are factual, interpretations and conclusions drawn from them may be controversial. It is debatable whether the chosen measure of full stocking (an established tree on 80 percent of the milacres in a sample) is too high or too low; whether balsam fir and/or hardwoods are satisfactory or unsatisfactory replacement species in original spruce forests; methods of sampling used. Debate at least indicates interest."

Arithmetic measures of stocking adopted were:

STOCKED QUADRATS, ALL SPECIES

| Class | Number of Stocked Quadrats per plot | Percent |
|---|---|---|
| Fully stocked | 16-20 | 80 to 100 |
| Well stocked | 12-16 | 60 to 79 |
| Moderately stocked | 8-12 | 40 to 59 |
| Understocked | 4-8 | 20 to 39 |
| Failure | Under 4 | Under 20 |

Major conclusions are: (1) On areas disturbed by logging and then fire, coniferous regeneration was a complete failure or, at best, insufficient. Advance regeneration, which is of utmost value, was destroyed, as was the favorable seedbed of moist rotting wood, and in some cases the seed as well; (2) On areas disturbed by fire alone, results varied, but were on the average unsatisfactory. Severity of fire and survival of seed trees was the key; second burns were fatal to coniferous regeneration; (3) West of Lake Superior, regeneration following any disturbance was much less abundant than in the east. Less moisture and slower decomposition of ground litter are the main factors. Finally, since this was not an inventory, further work by provincial services and industry needs to be undertaken to find the percentage distribution of stocking classes in various areas.

The completion of the first stage of this undertaking is evidently

stimulating great interest in the whole problem of forest regeneration in Canada. It may be hoped that, with the facts and causes brought to light, measures will be devised and put into effect to halt devastation and serious understocking, and to maintain the immense forests, so important to the national economy, in a fully productive condition. The work already done, and that now beginning, should be of interest to other nations in the northern coniferous region.

UNITED KINGDOM

• It is reported that two Chilean beeches, *Nothofagus procera* and *N. obliqua*, introduced into parts of England 50 years ago, show remarkable progress. Stems 50 years old are straight and clean, 100 feet (30 m.) in height; the two species are hardy and apparently able to thrive on acid as well as on limestone soils. *N. obliqua* is reproducing freely from self-sown seed. The species show the same features in their natural habitat and there would appear to be a good future for these trees, as well as for *N. dombeyi*, as timber producing species in England.

UNITED STATES OF AMERICA

• Recently studies have been made of 15-year-old stands of loblolly pine (*Pine taeda*) and eastern red cedar (*Juniperus virginiana*) on abandoned fields in Mississippi.

The studies were made to determine the comparative value of these species in soil protection and water absorption. Loblolly is a desirable species for flood control planting, since it produces large amounts of litter in a short time, and the surface layer of soil absorbs water faster than under herbaceous cover. Red cedar develops even more desirable characteristics in the surface soil than does loblolly, and planting of this species is indicated when the primary objective is soil rehabilitation rather than flood control.

## Logging and Engineering

UNITED STATES OF AMERICA

• In the ponderosa pine forests of eastern Oregon and Washington, forage is of major importance to the economy of the region and, since logging is progressing rapidly, a study has been conducted on the effect of logging on forage production. Tractor logging denuded herbaceous and shrubby vegetation from 21 percent of the ground and covered 5 percent more with slash; cable logging denuded 15 percent and covered 15 percent with slash; horse logging denuded 12 percent and covered 5 percent with slash. Deep soil disturbance occurred on 15 percent of the tractor logged area and on about 2 percent of the area logged by other methods. Where soil disturbance totalled 44 percent, the density of herbaceous and shrubby vegetation was reduced 47 percent. It is possible that artificial revegetation of the disturbed areas may be desirable, both to restore forage values promptly and to protect the disturbed lands from erosion.

## Forest Injuries and Protection

CANADA

• *Forest Fire Protection Abstracts*, prepared by the Forestry Branch, Canadian Department of Resources and Development, is a valuable addition to the publications available to the many foresters who specialize in this field. Articles selected are naturally those of particular interest to Canada. Categories are: Communication; Detection; Fire Danger Measurement; Fire Control Organization and Planning; Prevention; Suppression Methods; Suppression Equipment; and Miscellaneous.

JAPAN

• Forest fire insurance was first started in Japan in 1920, and in 1937 was taken over by the Government in order that small private owners could derive greater benefits from the service. Forest fire insurance applies to young forests less than 20 years old which would have relatively little salvage value if they should burn. That this is a popular program is indicated by the fact that by the end of 1938, one year after it was taken over by the Government, there were outstanding 19,420 policies covering about 300,000 acres (120,000 ha.) valued at 14,360,000 yen or about $ 7 million. By March 31, 1951 there were 79,651 policies covering 486,978 ha. at a value of over 4,601 million yen ($ 2,200 million).

UNITED STATES OF AMERICA

• A recommendation that uniform reports be made on individual fires wherever fire control is attempted was put forward by the group of foresters who, under the sponsorship of FAO and ECA, studied fire control in the U.S.A. in 1951. It was proposed, too, that FAO prepare a standard reporting form and sponsor its adoption.

In the U.S.A., uniform and comprehensive reporting was adopted by the Forest Service in 1921 (although the forms have been changed from time to time as experience indicated), and most of the other fire control organizations have similar systems. This step was taken because analysis of thousands of individual fire reports had proved how indispensable such records were as a basis for relating causes and effects, identifying weaknesses in an existing organization, and in indicating ways in which improvement may be sought. This source of primary data [illegible] research has been widely [illegible] U.S.A. The analyses have [illegible] varying forms as workers in diff[illegible] forest regions and in different [illegible] ganizations naturally sought solution to their own particular fire problems. In Finland during the twenties Prof. E. Saari similarly used individual reports in analyzing fire control.

The most recent employment of the method is in Station Paper No. 28 of the Northern Rocky Mountain Forest and Range Experiment Station, which analyzes 36,000 fires recorded by the protection agencies in the Northern Rocky Mountains between 1931 and 1945. In this region the Forest Service has contributed greatly to fire control planning methods by defining a graded series of fuel types and by devising ways to measure the burning index. By relating the data from individual reports to the types and index data, a multitude of significant correlations can be made. Indeed, each body of data supports the other so that the unsolved elements of the practical task of controlling fires stand out, as do the directions in which solution may be sought.

Not the least interesting aspect of this study is the comparison between the traditional lookout detection plus ground attack on the one hand, and the current air-plus-ground detection and attack on the other. There is also an indication of the comparative behavior of fires in areas that have already been cut or burned over as against the undisturbed timber types. This particular region has long been occupied in handling the occasional concentration of lightning fires which tend to swamp the organization. But man-caused fires, though decreasing are still responsible for nearly half of the area burned. Evidently further attention is needed with regard both to prevention measures and to quicker and stronger attack on such fires.

Particular attention has been given in this study to the effect on fire behavior of topography, fuels, and weather, and their relation to the rate of ignition and rate of spread. Analysis of these factors gives a powerful guide to the planning and operation of the control organization.

This study should strengthen the planning basis for improving fire control. It will surely be of value to fire control officers in other countries as a convincing example of the many ways in which analysis of detailed records of experience helps the vital and difficult task of forest fire control.

• In the Pacific Northwest, a major expense is control of alder and willow on the edges of fire protection roads, since these species sprout vigorously when cut and spread rapidly into the road space.

Experiments have been conducted, using a standard tank truck, a one-inch (2.5 cm.) fog nozzle and 6-foot (1.8 m.) applicator for spraying the samples of roadside vegetation. The most effective material was sodium

salt 2-4-D at the rate of 500 parts per million applied between mid-May and early July.

● For 15 years, studies of the ecology of the Sierra Nevada gooseberry (*Ribes roezli*) have been under way as part of the program of blister rust control in the mixed conifer forests of the Sierra Nevada Mountains, California.

Analysis of this work now makes it possible to draw some general conclusions regarding control operations and to confirm the extreme complexity and long range nature of the problem.

The gooseberry establishes itself readily and profusely after any form of disturbance such as fire, logging or grazing, and produces seed profusely in 3 to 6 years, which remains viable for many years in the forest floor. *Ribes* grows and develops rapidly in the early years after disturbance, then gradually declines and, in very dense timber stands, tends to disappear. Seed is widely disbursed through the forests by animals and birds and remains latent until conditions suitable to germination occur.

If control is undertaken after *Ribes* plants have produced seed, frequent and costly treatments are necessary as new plants are established. Therefore the most desirable time for control is the brief period after seed germination and before seed formation. A somewhat less desirable time for control is long enough after disturbance, when new seedlings are no longer appearing and control of the dwindling older plants only is required. Control operations begun during the major period of growth and seed production are likely to be relatively ineffective.

*Ribes* control is a part of the problem of sugar pine (*P. lambertiana*) management. Sugar pine reproduction after logging commonly requires considerable opening of the forest, probably enough to stimulate *Ribes* germination. In general, the forest is not suited to clear felling which if it could be used, would make the problem of *Ribes* control relatively simple. Despite the difficulties, control must be achieved in view of the extremely high value of the sugar pine, always present in forests with a considerable proportion of less valuable tree species.

### Viet-Nam

● Article 68 of the decree of March 1930, which is still in force and which constitutes the forestry charter in Indochina, makes the following provisions with regard to " rây " (shifting cultivation):

The entire classified and protected forest domain, as regards rây, is divided into three zones: (1) A " green " zone where rây is prohibited; this includes those portions of territory which, in the interest of public welfare, require either the absolute maintenance of the forests or the complete elimination of rây. This zone necessarily includes the entire classified forest domain. (2) A " red " zone where rây is restricted; this pertains to those forests of territory not included in the green zone which can be kept under strict surveillance. Rây is only permitted in areas properly selected and delimited, and under rotation long enough to avoid soil degradation, and must be completely surrounded by a peripheral strip at least 100 m. wide on which the original vegetation of no matter what kind is maintained intact. Finally, it may also be obligatory to replant the areas to which rây is limited with forest species. (3) A " white " zone, where rây is tolerated; this includes forests where no effective inspection and surveillance can be ensured. Here rây is tolerated without any special formality, with the reservation, however, that the area be completely surrounded by a peripheral strip of the primeval vegetation, 100 m. wide at least, as in the case of the red zone.

The division of the classified and protected forest domain into these three zones is the function of the local chief administrator of each province on the scheme established by the chief of the local water, forest and hunting service. This is based on the procedure laid down in Article 7 of the same decree which deals with forest classification.

The location of the areas where rây is permitted and the establishment of a rotation system in the red zone is a matter for the chief of the local water, forest and hunting service.

## Mensuration and Surveying

### Germany

● In 1948, Bitterlich published in German a rapid method of sampling tree basal area per acre without measurement of plot radius or tree basal area. Though widely used in Europe, the method has been overlooked elsewhere although it has considerable potential value in speeding up sampling. The method, which is based on sound mathematics, a special instrument, and standard procedures, is described in a recent issue of the *Journal of Forestry* (Vol. 50, No. 1, January 1952).

### United States of America

● The problem of timber evaluation from aerial photos is under continuous study at the Central States Forest Experiment Station. Methods have now been developed whereby air photos alone can furnish the necessary data where a 10 percent margin of error is admissible and where volume by species or diameter class is not required. Tests over both small and large areas show that reasonable accuracy is attainable.

The first step is preparation of aerial volume tables (already noted in *Unasylva*, Vol. V, No. 4).

The second step is the preparation of the photos and template. Next, the total area to be measured and the various forest classifications must be determined; these should be based primarily on characteristics easily recognized on air photos. Plot volumes are estimated on a predetermined number of one-acre plots mechanically selected on the photos when the number of plots in different classifications has been determined. The volume is determined from average total height, average crown diameter and percent crown coverage of the dominant stand — all determined from the photographs. The mean volume per acre for a given classification is obtained by averaging the volumes assigned to the plots in that classification. Normal maps are unnecessary, but mosaics of the photos may be prepared for later use in management if required.

Considerable time can be saved by this method in comparison with methods involving field measurement of plots. The limitations of the method are that individual trees cannot be precisely measured, cull estimated nor species identified. If information on these is required, field work on selected plots is necessary.

## Forest Management

### United States of America

● Forest grazing in the eleven southern states is a long established and widespread practice and, since it is traditionally accompanied by deliberate burning of the range, it has long been recognized as damaging to the standing timber. When fire control is effective, forage yield drops from a ton per acre (0.4047 ha.) to as little as 100 pounds (45 Kg.). Many studies show that the traditional year-long grazing of forest ranges is very bad animal husbandry, since the nutritive value of the main forage species varies greatly from season to season. Nevertheless, there is substantial forage in the southern pine forests which, under correct management, can be utilized to produce better quality meat and without disadvantage to forestry.

On areas once restocked to desired timber species, forage can be harvested for a few years. On firebreaks within the forest areas, desirable forage species can be established and can provide feed for a long time. The general pattern of development needed comprises pastures for the use of livestock during seasons when the nutritive value of the forest range is low, use of better grades of livestock, fencing of ranges so that grazing can be fully controlled, and reseeding of selected areas to desirable forage species.

So far, work shows that beef production can be doubled, tripled or quadrupled with improved management in the directions indicated, and that better quality meat will also result.

● In California, a project for burning brushlands to improve forage is being followed by the collection of information on costs and returns. On areas for which reliable figures are available, an average of only 56 percent of the area attempted was actually burned. Cost of burning averaged 29 cents per acre (72 cents per ha.) on total acres in the burn, divided into 19 cents for preparation of fire lines, 6 cents for burning, and 4 cents for fence repair. About 26 percent of the area has been reseeded, mostly by air, at a cost of $ 2.32 per acre ($ 5.73 per ha.) actually seeded. Information on results in forage production is fragmentary; in two areas it appears that grazing capacity was increased from 0.2 animal unit months per acre (0.5 per ha.) before burning to 0.8 (2.0 per ha.) the first year after the burn. Further information is expected as additional results are analyzed.

● In industrialized areas of Alabama forest depletion is very severe since the coal and iron mines use the best trees of small sizes for mining timber, in addition to the usual drain for other purposes. The mines use one-fifth of the wood marketed in the territory. Thus the forests contain a large proportion of undesirable hardwood stumpage. The mines accept hardwood props, but cutters prefer working in pine.

A recent study of costs of producing pitprops indicates that direct costs were 20 percent greater for hardwood than for pine props. It was found that for felling trees 8 inches (20 cm.) d.b.h. and larger, and for bucking logs or bolts larger than 7 inches (18 cm.) in diameter, the 3-man power chain saw is cheaper than other methods, provided it operates steadily. Splitting bolts from large trees reduces the cost of props, and topping time increases rapidly as diameters larger than 6.5 inches (17 cm.) are chopped.

Since most of the props are cut from company lands which, as a consequence, are deteriorating, mining companies themselves are suffering a loss through their general failure to utilize low-grade hardwoods. Company landowners could encourage use of the hardwoods by reducing or eliminating stumpage charges to cutters.

## Forest Products and their Utilization

### Canada

● In eastern Canada, about 30 percent of the log volume sawn into spruce lumber is in slabs and edgings, unusable as lumber but containing good wood. At 60 selected sawmills it was found that 62 percent of the slabs, edgings and trim was utilized as fuel at the mill or sold as fuelwood, 6 percent was manufactured into small products, and the remaining 32 percent was unused. Utilization of such material for pulp is possible only if the slabs and edgings can be debarked economically, and a special research co-ordinating committee on the utilization of mill waste for pulpwood, including technicians and representatives of companies, has recently been formed to study the question.

As the first step, the committee has brought together and summarized information on the various debarking processes now in use, with particular reference to their applicability for handling slab wood. All barking machines at present in use can be classified into four main groups, employing (1) cutting knives, (2) rubbing friction, (3) hydraulic erosion, and (4) thermopressure.

1. *Cutting Knives.* Eight barking machines are included in this group, all employing some arrangement of knives for cutting the bark from the log. As a result of this cutting action, some wood is lost together with the bark. Most of these machines are designed to handle only small wood such as poles, pulpwood bolts, and slabs, although two machines of this type bark large logs.

2. *Rubbing Friction.* Eight more machines are included in this group, four of which are designed to handle sawlogs while others handle small pulpwood bolts or poles. Bark removal is accomplished through various arrangements of chains, scrapers, or the rubbing of the logs against one another.

3. *Hydraulic Erosion.* The six in this group are all relatively expensive, have high power requirements, and are designed, with the exception of the hydraulic slab barker, to handle large logs. The actual barking operation is accomplished through the action of a stream, or streams, of water directed at high pressure onto the bark, thus stripping it from the log. Information on two other machines, the original Weyerhäuser — believed to be a single nozzle hydraulic — and the Simons Rotary-head barker, which resembles very closely the Hansel ring type, was not available when the report was published.

4. *Thermopressure.* This method still in the development stage, constitutes a new approach to the problem of bark removal. The material to be debarked is inserted into a stainless steel cylinder, steam pressure is applied and then released suddenly. The bark is reported to be " exploded " from the wood.

The whole-log barkers now in use are expensive and thus limited in use to larger mills. The buzz barker has a relatively low cost, but its capacity is only about 2.8 cords (7 cu. m.) per man-day. In addition, information has been obtained on the air-float method of bark separation which, however, does not remove bark from bark-covered chips but merely segregates the different types of chips.

### Hawaii

● A large scale project is [illegible] ting under way which will inv[illegible] comprehensive study of the possi[illegible] ities of utilizing sugar-cane ba[illegible] gasse. This project is sponsored by the Hawaiian Sugar Planters' Association and other concerns in their efforts to strengthen Hawaii's economy with the new industries. An all-out effort will be made to develop the fullest commercial use of bagasse for pulp, paper, feed and other products. A group of experts from the American pulp and paper industry has joined experts of the sugar industry on this project.

### Japan

● The Natural Resources Section of General Headquarters, Supreme Commander for Allied Powers, has recently isued an admirable summary of the properties and uses of commercially important Japanese woods. There are 176 species of timber trees important to Japan, including 22 exotics. Comparative analysis of strength properties of 98 Japanese woods and of 68 woods grown in the United States identifies 28 American species comparable in properties with specified Japanese woods. A detailed listing of the woods used in order of importance for a large number of purposes is given with particular emphasis on construction of boats, since practically all Japanese boats are of wood. Forty important species are described, giving wood qualities and characteristics, nail penetration, working qualities and durability. The important uses of the principal species are likewise summarized with, finally, a list of the commercial woods used in Japan, giving the Japanese names in Romaji and in Hiragana, the scientific name and the English name.

This summary should be useful in helping to extend the life of Japan's timber reserves by making data available on many little-used species that can be substituted for woods in great demand but in short supply.

### Mozambique

● A report on Portuguese East Africa states that a printing firm has announced its intention of forming a company to erect a paper-making plant in the province. The intention is to utilize raw material such as papyrus, long grasses and canes, sugar cane, sisal and cotton waste and others, which grow, or can be grown, locally. The paper mill will produce some 20 tons of paper of all sorts daily, and the pulp mill will produce daily an additional 50 tons of pulp. This surplus pulp will be exported.

### Rumania

● From several official publications come reports of the development of the timber industry in Rumania. Before the present 5 year plan (1951-

1955) began, mechanization was already under way in many sawmills, wood-using and veneer plants. Logging tractors, cranes and automobiles are now replacing the traditional ox in logging operations. In the Carpathians aerial cables are being used for log transport and remote timber tracts are being opened up by narrow gauge railroads. In 1949, 230 km. of such roads were constructed and in the same year one of the largest aggregates of wood-using plants was put into operation at the town of Vatra-Dorney.

From 1951 to 1955 some 23,800 million lei[1] are to be invested in the building up of forest industries. Productivity in the sawmills has also increased, and sawn lumber production (1948 = 100) rose to 133 percent in 1949, and 160 percent in 1950. In the last few years furniture production too has expanded, and from 1949 to 1950 production of high quality furniture increased by 43 percent, while mass-produced furniture for domestic use doubled. An entirely new industry has also come into existence — the production of prefabricated houses. Since productivity depends to a large degree on the skill of the workers, efforts are being made to raise the technical qualifications of wood workers through vocational schools. In 1951, 6,000 workers were trained. There are 17 schools and institutes of the middle grade for training engineers and technicians for the timber industry alone.

### United States of America

● Increased interest in utilization of sawdust, shavings and similar wood waste for production of board materials has resulted in experiments with methods other than the wet-forming process, which is limited to the use of coarser types of wood waste.

One attempt is the production of cemented boards for use where some structural strength and insulation are important. However, only specially cut wood wool can be used for this process and not random sawdust and shavings.

There have been a number of successful applications of the dry-formed or resin-bonded board. One advantage is that these dry and semi-dry processes lend themselves to use in smaller plants (15-30 tons a day) than is economical for the wet-formed process (50-100 tons). The smaller plant can be installed at approximately two-thirds of the cost of the latter. There are additional costs, particularly that of resin binders in the dry-formed process, but the resulting boards are superior in hardness and nail- and screw-holding properties. At present, the critical short supply of resins is likely to be a limiting factor in the expansion of plant capacity.

● After extended and costly research, the Du Pont Company has developed a new way of adding synthetic rubber, neoprene, to paper. The neoprene is now added in latex form to the pulp just before it is made into paper, resulting in a new type of low-cost specialty paper which has the advantages of wet strength, chemical resistance and all-round improvement in physical properties compared with those produced by older methods of coating or saturating the finished paper.

[1] 150 lei = US $ 1. app.

## Forest Policy

### Bulgaria

● Bulgaria is in the middle of its first 5-year plan, 1949-1953, which provides for a new appraisal of the forest resources of the country, their condition, the measures that are being taken for their improvement and plans for the future.

The forest area of Bulgaria is estimated at 3.3 million hectares, of which under 3 million (26.7 percent of the total land area) is actually covered with timber. Conifers occupy 13 percent of the timbered area and are concentrated chiefly in the southwest of the country along the slopes of the Rhodope, Perin and Rill Mountains. Pine (61 percent) is the predominant conifer, followed by spruce (26 percent) and fir (13 percent); the coniferous stands are mostly middle-aged or approaching maturity. Hardwoods (beech and oak) for the bulk of Bulgarian forests covering 2,570,000 ha. or 87 percent of the timber covered area. Of the hardwood stands 28 percent are high forest, and 59 percent are of sprout origin; beech forests are found mostly on the slopes of the Stara Planina Mountains which transect the country from west to east, and consist for the most part of mature and over mature stands. High oak forest occupies only a small area, mainly in the east and southeast of the country. Some are dying from the top due probably to a change in the water regime caused by prolonged droughts in latter years. Sprout forests, mostly of oak, are found in the valleys and foothills. The condition of all types of forest is on the whole very poor, due to irregular cuttings in the past, overgrazing, and lack of protection.

Since the country is largely mountainous and whatever forest vegetation there is, is confined to the mountain slopes, nearly all forests are classed as watershed protection forests (89 percent of the total forest area). No clear cutting is allowed and grazing is restricted.

The cut for the whole country is 5 percent higher than the annual growth, but is very unevenly distributed. The cut of conifers, around which the forest industry is centered, is often twice as large as the annual growth, while only half of the hardwood growth is utilized. A large reforestation program is under way, and within the last 6 years some 85,000 ha. have been planted or sown. Within the next 12 years 990,000 ha. are to be brought into productivity through planting, assisting natural regeneration, etc. Forest specialists are trained in the Forestry Department of the Agricultural Academy in Sofia where the Central Forest Research Institute is also located. There are two forest technical high schools, one in Velingrad and the other at Tetven, and four forest schools for training lower forest personnel with a 2-year course.

Forest fires have always been a scourge of the country and are often started by the peasants to increase pasture lands, of which there is a great scarcity. Although measures are now being taken to combat forest fires, they are still very prevalent, and in 1950 as a result of the drought the number was especially great. More than half of the fires (56 percent) are caused by negligence; 35 percent arise from unknown causes and 9 percent by sparks from locomotives.

### Gold Coast

● A recent summary of the resources and reserves of the Gold Coast forests and of the timber industry brings out some significant facts. Forest reserves cover 5,800 square miles (15,022 sq. km.) of which 3,428 square miles (8,879 sq. km.) are actually or potentially accessible for timber production. Forest lands outside reserves cover 10,200 square miles (26,418 sq. km.) but are being cleared at the rate of about 300 square miles (777 sq. km.) a year for farming. The policy is to exploit the land outside the reserves now, in order to remove the valuable timber before it is destroyed in land clearing. In the reserves, where cutting is rigidly controlled, the policy is to cut only mature and over mature trees.

The Forestry Department has 4 divisions, each under a Conservator of Forests with several districts and many ranges under him, all reporting to the Chief Conservator.

About 800 square miles (2,000 sq. km.) of additional reserves are desirable in order to maintain a large export trade. Timber exports have increased from 600,000 tons before the war to 7 million tons in 1948, and their value has risen from £ 60,000 to £ 2,500,000. About 88 percent of exports are logs and 12 percent sawn lumber. Of this, 94 percent of the logs and 85 percent of the sawn lumber goes to Britain and the United States. Before and during the war, nearly all exports were mahogany, but by 1948, 28 types of wood were being exported.

The number of sawmills has increased from five before the war, with an output of 260,000 ft.$^3$ (7,000 m$^3$) a year, to 15 today, with an output of 1 ¾ million ft.$^3$ (50,000 m$^3$) a year. Three additional mills are being constructed which will raise total output to 2 ½ million ft.$^3$ (71,000 m$^3$) a year.

At present the demand for rail transportation cannot be met owing to the shortage of locomotives and rolling stock.

### Iceland

● Comparison of climatological data in Iceland, Northern Norway and Alaska indicates that, since the meteorological stations in Norway and Alaska are in areas well stocked with coniferous forests, great parts of Iceland would be in the northern coniferous belt were it not for the isolation of the country.

The native flora includes only about 430 different species of higher plants and pteridophytes, nearly all of European origin, but only about half the number found in Scandinavia under similar climatic conditions.

At the time of the first settlement, about 900 A.D., most of Iceland was covered with forests, principally of birch of which three species were found, together with three willows, mountain ash and dwarf juniper. Coniferous trees did not reach Iceland after the last ice age. The original birch forests were devastated through the use of the country by the settlers, and widespread and severe soil erosion resulted. Sheep and cattle raising were the main livelihood and, since hay-making was extremely limited, livestock was left to shift for itself. This use of the land plus heavy cutting of the birch forests for fuel and wood has reduced the total vegetative cover to about 40 percent of the original. This no longer provides an adequate source of timber; imports averaging $^1/_2$ $m^3$ per head per year are therefore necessary. The devastation has not yet been severely felt since the country is thinly populated, but it is evident that the ranges and pastures cannot stand heavier grazing than at present. Most of the remaining vegetated area has been reduced to brushwood, though there are remnants of the original forest.

Experiments in planting imported conifers were begun in 1899 and continued up to 1913, after which nothing was done until 1933 when reforestation was again started. In the earlier experiments, less was known about climatic conditions in Iceland than now, and trees from continental climate areas too far south were used, since it was difficult to obtain seeds from areas resembling Iceland climatically. Of the seven conifers used, six were from European sources and one, *Pinus aristata*, from high altitudes in Colorado, U.S.A.

In later afforestation work, species from northern Alaska, northern Norway and Russia have so far given far better results than those obtained with the earlier work. *Larix siberica* from Russia, *Picea abies* from Norway, *P. sitchensis* from various sources, *P. Engelmanni* from Colorado, U.S.A., *Abies lasiocarpa* from Oregon, U.S.A., *Pinus silvestris* from Norway, *P. contorta* from British Columbia, are all under test, and so far giving promising results. Where material from carefully selected sources is used, it seems clear that timber will be of economic importance in the future.

One of the most interesting results is the success of the species from the United States which seems to indicate that length of solar radiation in summer is of less importance than was believed, and that there is thus the possibility of using species from high altitudes.

### Pakistan

● The status of the forests of the North West Frontier Province of Pakistan is summarized in a recent report by the Inspector General of Forests who works under the Ministry of Food and Agriculture.

In the settled districts, forests cover only 4.2 percent of the total land area, and only 2.1 percent consists of reserved forests; in the tribal areas, the percentages are probably not much greater. The forest situation as a whole is considered appalling, since a large proportion of the reported unclassed forests are already destroyed. Systematic forestry started in 1867, but only in one district, and it was not until 1930 that a Forest Circle covering the whole of the Province was formed. However, in 1880, fine canal plantations and roadside plantations were begun and, in 1926, timber import regulations were introduced. During World War II, emphasis was placed on a maximum output of forest products of all sorts.

Erosion is severe on the hills, due to the indiscriminate cutting of firewood and to uncontrolled grazing, which prevents the establishment of trees or brush. Gullying has spread to the farmlands and is increasing. Moreover, the population is growing so that these problems are likely to become more severe. The average annual net revenue during the 5 years 1944/45 through 1948/49 was Rs. 3,960,976. [2]

Recently a system has been voluntarily adopted by landowners to close their land to grazing, but only 39,000 acres (15,780 ha.) have so far been registered. Working plans are generally unsatisfactory and behind schedule, except those for the main plantations which are reasonably up-to-date. Anti-erosion work has been begun successfully, and emphasis is being placed on additional planting.

However, major reorganization is regarded as essential. Most divisions are at present too small, and most of the gazetted officers who were promoted from subordinate posts were trained only in the ranger class, leaving a dearth of officers with higher training. It is proposed that salaries be raised on the basis that it is more economical to have fewer well-paid officers than a large number of low-paid and discontented officers.

[2] 1 Rupee = US $ .30 app.

This reorganization, together with the task of increasing the area and distribution of reserved forests, stands out as major problems for the future administration.

### Timor

● A new Department of Agriculture and Animal Husbandry, including a Forestry Section, has been set up in Portuguese Timor. Timor has three main types of forest: the deciduous or monsoon which preponderates over the whole island as primary and secondary formations (dominants: *Schleichera, Pterocarpus*); the evergreen (dominants: *Eugenia, Intsia, Pometia, Ficus, Pterospermum, Carnarium*); and the mountain forest, composed mainly of *Podocarpus* and *Casuarina*. Not included in the original climax forests are also the large characteristic stands of *Eucalyptus alba* and *Eucalyptus decaisneana*.

### United States of America

● The American Society of Range Management, both through a Society Committee on Curricula and through symposia reported in the Journal of Range Management, is giving attention to the problems of professional education in range management. The position of range management in training establishments is highly varied. In some schools, the subject is taught as a separate major subject in range management departments, independent of other fields. In others, it is included in departments of forestry, animal husbandry, botany or agronomy. The content of the curricula is strongly flavored by the dominant subject matter of the department. It is quite obvious, then, that some effort toward greater uniformity and some degree of standardization of curricula is desirable, particularly since in some schools little or no instruction is given in either forestry or in the basic sciences. The size of the teaching staff varies from one to nine and, in many cases, teachers are spending a good deal of time on independent research. Of teachers holding doctor's degrees, nearly all obtained the degree in plant ecology from one of the recognized universities.

The first courses in range management were set up to supply the demand of the public agencies, such as the U. S. Forest Service and the U. S. Bureau of Land Management, and thus the instruction aimed to fit students for range management work or range research. Accomplishment of effective management, however, rests primarily on the private owner of range livestock and of rangeland, since all stock and at least 25 percent of the land are privately owned. Thus there are two requirements for all-round range education over and above technical knowledge of the range itself, namely, ability to prepare technical material so that it will be intelligible to, and used by,

owners unfamiliar with conventional types of scientific material; and, second, to devise means for extension work with owners, either singly or in groups. Thus analysts of the range school problem are emphasizing training in these arts in addition to the usual technical subject matter and basic sciences. Such broad training is regarded as desirable, both for men who will be administrators and researchers.

Increased attention is being given to basic ecological facts about grasslands, both in training students and in educating range users. Essential facts are: (1) if the parts above ground are kept grazed down the roots are killed; (2) nature abhors a vacuum, and when desirable species are killed out, space is captured by undesirable species; (3) nature keeps trying to put back the same kind of vegetation on areas from which it has been removed; (4) the principal factor limiting growth in grassland climates is soil moisture, and thus provision must be made by retaining part of the vegetation to get water into the soil from whence it will be drawn by the plants. At least half the year's growth should be so reserved to maintain proper conditions.

There is a rapidly growing body of technical books and papers on the various aspects of range management, the more significant of which are reported currently in the Journal. A revised and up-to-date textbook on range management by A.W. Sampson (*Range Management: Principles and Practices*, John Wiley and Sons, Inc., New York, 1951. US $ 7.50) has now been published and attention should also be drawn to "Improving the World's Grasslands," FAO's Agricultural Study No. 16.

● Educational work in farm forestry is conducted by the state agricultural extension services of the land-grant colleges, in co-operation with the Department of Agriculture's Extension Service, and with the Forest Service which provides basic information. Forty-five states and one territory now employ one or more extension foresters. Other Federal, state and private agencies are consulted to make the program as effective as possible.

Farm forestry extension is a program of non-resident instruction carried on through leaflets, bulletins, circular letters, information in newspapers and farm journals; method-and-result demonstrations; visual aids, such as films, slides, and fair exhibits; radio and television; and through meetings and other contacts with farm workers. The state extension forestry specialists work closely with the county agricultural agents. Topics covered include farm woodland management, utilization of farm woodland products on the farm, marketing of products, timber estimating and appraisal, planting windbreaks and shelterbelts, preservative treatment of farm timbers and fence posts, wildlife management, prevention of farm fires, and production of naval stores and maple syrup.

Important among last year's activities were demonstrations of tree-planting machines for establishment of windbreaks, shelterbelts, and future timber crops. There were also demonstrations in the use of the power saw. This labor-saving device has stimulated many farmers to do their own logging, and has aroused their interest in log grades, log scaling, potential markets and market prices, and in instituting good cutting practices in their farm woodlands.

Through the 4-H Club program, a special effort is being made to provide rural youth with an understanding and appreciation of forestry. In this work, 167,745 boys and girls last year received training in forestry, and 572,917 in fire and accident prevention.

● A review of the timber resources of the United States, which will take at least 2 years to complete, is being carried out by the U. S. Forest Service. It is planned to bring up to date information on timber resources, to re-analyze prospective requirements, supplies, and growth of timber, to appraise current timber-conservation programs, and chart a course for American forestry. Advice in planning the project and help in determining the facts of the forest situation will be sought from state and private forestry agencies, the wood industry, and conservation organizations.

● The American Forestry Association has recently made available an up-to-date sequel to its comprehensive Forest Resources Appraisal, which was published in 1946 and was done concurrently and in association with the appraisal conducted by the U. S. Forest Service at the same time. The new report was made because of the very rapid changes of the past five years in American forests and forestry.

It is announced that for the first time all state and private forest lands on the Pacific Coast are under organized protection, but that 82 million acres (33 million ha.) elsewhere, mostly in the southern states, are still unprotected. Efforts to control insects and disease are still very much below needs. Current production of nursery stock is about 230 million seedlings, and there are more than 600 tree-planting machines in use, but only a start has been made upon the acreage that should be planted. Fully satisfactory watershed conditions exist on only a small portion of public lands, and a still smaller part of private forest lands. Only about one-fifth of the total private forest lands fall within the 12 states which have laws governing cutting standards on such lands.

### Union of Soviet Socialist Republics

● An article in the Russian periodical *Lesnoye Khoziastro* says that the plans of the Ministry of Forestry, made known in 1951, call for completing the mapping, surveying, and inventorying of all the forests of the USSR (other than those belonging to the State and the collective farms) between 1951 and 1955. Standard instructions have been issued as to the methods of surveying, estimating the economic possibilities of the different forests, etc. The field work is to be carried on from May to November and the computation of the data, in the off-season. It is evident that until these forests are surveyed and administered on a more or less permanent basis, all present available statistics as regards area, stand, cut and growth must be considered as mere approximations open to all kinds of interpretation. This is especially true of the amount of timber cut each year; published estimates of the present annual wood cut of the Soviet Union vary from 269 million to 660 million cubic meters. The FAO *Yearbook of Forest Products Statistics, 1950*, gives 269 million cubic meters as the total production for 1949. The statistical volume of the ECE/FAO *Study of European Timber Trends (1913-1950)* gives an estimated production in the USSR for 1950 of 600 million cubic meters, consisting of 320 million $m^3$ of industrial wood and 280 million $m^3$ of fuelwood. These figures correspond to the trends in the growth of the timber industry observed during the last 30 years. In the twenties the annual consumption of timber of all kinds (including export) was around 200 million $m^3$; in the late thirties, it rose to over 300 million $m^3$; a present estimate of between 450-500 million $m^3$, considering the recent accelerated growth of industry, does not seem an exaggeration. These figures do not include the timber cut in the so-called "local" forests, of which there are now more than 100 million ha. At a cut of only 1 $m^3$ per ha. a year, this would amount to a considerable figure. If the cut from these local forests is added to the previous figures, as well as that obtained by other Government agencies outside the jurisdiction of the Ministry of Forestry, the article concedes that the 600 million $m^3$ estimated by FAO as the amount of timber cut each year in the entire USSR may not be very much out of line.

# Reviews

*It is the policy of FAO to review here only selected publications which appear to have a direct bearing on the current work of the Forestry Division.*

STABILITY AS A FACTOR IN EFFICIENT FOREST MANAGEMENT. A. Koroleff. *Pulp and Paper Research Institute of Canada.* Montreal. 1951. Price: Can. $ 4.00.

The author, Director of the Woodlands Research Division of the Pulp and Paper Research Institute of Canada, defines the aim of his study as providing material for the use of the Canadian pulp and paper industries in their planning for greater continuity and stability in the use of forest labor and forest areas. The book deals mainly with forest management in eastern Canada, but contains some useful references to other countries.

The first chapter is devoted to forest labor management, and tackles the problem of stability and efficiency of forest labor as well as that of eliminating the effect of the season on logging. It is stated that in Canada the last item is a phenomenon of the greatest importance. While, for instance, about 85 percent of Canada's labor force are permanently employed, forest work is to such an extent a part-time occupation that in the eastern part of the country the labor force engaged in pulpwood logging during the winter has been as much as 3 to 7 times as great as in the summer. Since 1940, annual fluctuations of the total labor in pulpwood camps east of the Rockies have varied between a minimum of about 6.2 million and a maximum of about 11.6 million man-days. Moreover, there has been a very high, and apparently increasing, turnover of workers in pulpwood camps.

While it has not been possible to show with indisputable reliability whether there has been a definite upward trend in the output rate (which in eastern Canada for the last eleven years has averaged 0.69 cords [1.76 m³] per man-day), the daily earnings of forest workers, the majority of whom are semi-skilled, have been rising faster than the average remuneration of labor in the eight main industries of Canada. It is pointed out that a continuation of this trend will soon result in transient and semi-skilled forest labor being paid at a higher rate than permanent and skilled workers in the major industries.

High "seasonability" of logging does not foster a stable and efficient labor force. It had its advantages when there was a supply of cheap transient labor, but this source of manpower has diminished, due to increasing industrialization of logging and to higher wage rates obtainable elsewhere. Also, the former great advantages of winter haul have been, or can be, nullified by mechanization. It is stressed in this study that in certain conditions at least, it is not only possible, but even advantageous, to make logging and transportation entirely independent of the seasons by intensified mechanization. Two companies in Ontario which have recently changed to year-round logging are reported to have attained a relatively high degree of labor stability and some gains in efficiency.

In fact, in eastern Canada there has been an increase in the percentage of summer pulpwood cutting. In other parts of the country, as well as in certain other northern countries, there has been a more or less distinct trend to cease confining pulpwood logging to the winter, and to increase the percentage of permanent forest labor and the use of logging machinery and all-season roads.

The problems mentioned above are intimately linked with forest management, and it is this interrelationship with which the second chapter of the book deals. A number of papers were prepared especially for this book by Canadian, United States and European foresters and operators, dealing with the relative merits of the intermittent use of forest labor and forest areas versus their continuous use.

Under the present "nomadic" system, based on widely intermittent utilization of forest areas, practically all merchantable pulpwood is cut at once, and logging operations are then moved to a new place. Logging is thus advancing into less accessible areas. Heavy losses are suffered through abandoning temporary improvements, wood losses, inappropriate age of timber cut, etc. Also net growth of merchantable wood, per year per acre, is small and restocking often inadequate. Most of the measures by which wood losses can be reduced and growth and yield of wood increased are precluded by such nomadic operations. However, the application of the system in remote areas of mature and over-mature timber can be, for economic reasons, quite dependable. On the most accessible and best forest areas, the investments required for the stabilization of operations and intensification of forestry will be justified by the substantial economies resulting from forest management, good permanent labor, and continuous operating with high productivity and low costs.

According to findings of the study, there are five inter-related measures which form a group and should be introduced jointly: (1) "de-seasonalization" of logging; (2) logging mechanization; (3) a competent and contented labor force, with as many permanent employees as are needed for the minimum annual wood production; (4) continuous operating of each working unit on a sustained yield basis; and (5) integration of logging with silviculture and forest protection, to obtain the full benefits of sound forestry.

Since pulpwood operations in eastern Canada vary greatly according to physical, biological and economic factors, with even some important psychological factors, no uniform solution for their management problems is put forward. Planning has to be made individually for each case, and much specific research in forest management is still needed to give definite indications as to the most efficient methods.

RANGE MANAGEMENT - PRINCIPLES AND PRACTISES. A. W. Sampson. 570 pp. illus. John Wiley & Sons, Inc., New York. Chapman & Hall Ltd. London. 1952. U.S. $ 7.50.

This new work by the Professor of Range Management at the University of California undoubtedly represents a landmark in the history of the conservation and proper use of natural rangelands. It could not have been written except by a man of research, an ecologist, but it has the richness and quality that can only come from a lifetime of productive participation in the field. Professor Sampson's experience stretches back to his youth on the family farm in Nebraska and a photograph shows us the buildings there, protected by dense windbreaks of pines and hardwoods.

One of the great merits of the book is that it is the whole, rather than the separate parts, which is of the greatest interest. At the same time it balances theory and practise, without loss of emphasis for either point of view. In places the author does not hesitate to use the method of question and answer, for instance to deal with such complex problems as control of noxious woody vegetation on rangelands in the United States, or to show the practical implications of the conclusions that research has already reached. But Professor Sampson is especially to be commended on his success in covering all aspects of range management, tieing up on the one hand all the underlying scientific principles and techniques and on the other all the physical, economic, administrative, and social factors which are involved.

A brief analysis of the form of the book can best make this clear. It is divided into four parts. The first part sets out the problems of range management in their proper perspectives. After showing the

economic importance of rangelands, not only for the United States but for the world generally, the relationships of the problems involved to plant physiology and ecology are explained. Then, after discussing the characteristics of rangelands in the United States, the author broadly traces their historical development and the consequences of this development. Of special interest are the passages dealing with synecology and theories on the evolution of plant communities, as they apply to the range. The second part is concerned entirely with the botany of the principal forage species that go to make up the "range" in the United States.

The third part deals with management and improvement. Due weight is given not only to natural re-seeding but also to the various methods of artificial re-seeding which have proved their worth in the United States and elsewhere. Economic considerations are the limiting factor and cannot be disregarded in plans for rangeland improvement. A chapter is devoted to methods of gauging range "condition" which permit a determination of the relative stage of succession reached by a range and hence the type of management which will be to the best advantage.

Problems of protection are treated in the last part of the book, which does not have quite the same homogeneity as the earlier parts, and covers questions as diverse as the protection of livestock against predatory wild animals and injurious plants, the protection against livestock of valuable natural flora other than the range forage, and the protection of the rangeland against erosion. These various subjects have nothing in common except that they all relate to "protection, "but on the other hand they could scarcely be fitted in appropriately elsewhere in the book. It is a pity that the author does not have a summary chapter on the protective functions that the rangeland itself performs, or should perform, in relation to other lands and to the water regime. The importance of these functions is such that it can of itself justify the creation of special administrative services, such as those in the United States described in the last chapter of the book. Even though in North America this importance may be taken for granted, elsewhere in the world it is apt to be lost sight of by the wide circle of readers that Professor Sampson's book merits.

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